Clemson University
3 1604 019 888 124

Digitized by the Internet Archive
in 2013

http://archive.org/details/watersupplyirrig250unit

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPERS

Nos. 250-252

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

CONTENTS

Water-supply paper 250; Surface water supply of United States, 1907–08, pt. 10, Great Basin.

Same 251; Surface water supply of United States, 1907–08, pt. 11, California.

Same 252; Surface water supply of United States, 1907–08 pt. 12, North Pacific Coast.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 250

SURFACE WATER SUPPLY OF THE UNITED STATES

1907-8

PART X. THE GREAT BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

E. C. LA RUE AND F. F. HENSHAW

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

CONTENTS.

	Page.
Introduction	5
Authority for investigations	5
Scope of investigations	6
Purposes of the work	7
Publications	8
Definition of terms	11
Convenient equivalents	12
Explanation of tables	13
Field methods of measuring stream flow	14
Office methods of computing and studying discharge and run-off	19
Accuracy and reliability of field data and comparative results	24
Use of the data	25
Cooperation and acknowledgments	26
Division of work	26
General description of the Great Basin	26
Wasatch Mountain drainage area	28
Principal streams	28
Bear River basin	29
Description	29
Bear River at Dingle, Idaho	31
Bear River near Preston, Idaho	33
Bear River near Collinston, Utah	37
Logan River near Logan, Utah	40
Logan, Hyde Park, and Smithfield canal near Logan, Utah	45
Blacksmith Fork and power plant race near Hyrum, Utah	47
Weber River basin	52
Description	52
Weber River near Oakley, Utah	53
Weber River near Croyden, Utah	56
Weber River near Plain City, Utah	59
Provo River basin	62
Description	62
Provo River above Telluride Power Company's dam near Provo, Utah	63
Provo River at mouth of canyon near Provo, Utah	66
Hobble Creek basin	67
Description	67
Hobble Creek near Springville, Utah	68
Spanish Fork basin	70
Description	70
Spanish Fork at Thistle, Utah	71
Spanish Fork near Spanish Fork, Utah	73
Spanish Fork near Lake Shore, Utah	76
Diamond Fork near Thistle, Utah	78
Sevier River basin	79
Description	79
Sevier River near Marysvale, Utah	80
Sevier River near Gunnison, Utah	83

Page.
Humboldt Sink drainage basin 86
Humboldt River 86
Description 86
Humboldt River near Golconda, Nev 87
Humboldt River near Oreana, Nev 90
North Fork Humboldt River near Halleck, Nev 93
South Fork Humboldt River near Elko, Nev 96
Sierra Nevada drainage area 100
Principal streams 100
Truckee River basin 100
Description 100
Lake Tahoe at Tahoe, Cal 101
Truckee River at Tahoe, Cal 103
Truckee River at Nevada-California state line 105
Truckee River at Vista, Nev 108
Truckee River at Derby dam, Nev 110
Donner Creek near Truckee, Cal 113
Prosser Creek near Hobart Mills, Cal 115
Little Truckee River at Pine Station and Starr, Cal 117
Carson River basin 121
Description 121
East Fork Carson River near Gardnerville, Nev 121
Carson River and Brunswick Mill power canal near Empire, Nev 123
Carson River near Hazen, Nev 127
West Fork Carson River near Woodfords, Cal 128
Walker River basin 131
Description 131
East Fork Walker River near Yerington, Nev 132
Walker River near Wabuska, Nev 134
West Fork Walker River near Coleville, Cal 136
Owens River basin 139
Great Basin drainage in Oregon 139
Description 139
Silver Creek near Silver Lake, Oreg 140
Chewaucan River at Paisley, Oreg 141
Miscellaneous measurements 142
Index 145

ILLUSTRATIONS.

Page.
PLATE I. *A*, Current-meter rating station at Los Angeles, Cal.; *B*, Bridge station and cross section of stream, illustrative of 0.2 and 0.8 depth method 16
II. Price penta-recording current meters 18
III. *A*, View at head of proposed diversion canal from Bear River to Bear Lake; *B*, Headworks of power canal on Spanish Fork, Strawberry Valley project, Utah 30
IV. Portion of Lake Tahoe 100
V. *A*, Falls on Little Truckee River, one-half mile below Webber Lake; *B*, Power house of Truckee River General Electric Company at Mystic, Cal 102
VI. Diversion dam on Truckee River, Truckee-Carson project, Nevada 110
FIGURE 1. Discharge curves for Weber River near Croyden, Utah 21

SURFACE WATER SUPPLY OF THE GREAT BASIN, 1907–8.

By E. C. La Rue and F. F. Henshaw.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

> Provided that this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited to that which can be provided with the appropriations available. The field covered and the character of the work are believed to be the best that could be accomplished under the controlling conditions. It would undoubtedly be of more scientific importance and ultimately of more practical value if the money now applied to wide areas were concentrated on a few small basins. Such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be maintained during a period of years sufficient to cover all stages, in order that within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum may be determined. The length of such a period manifestly varies for different streams and can not be absolutely determined. Experience has shown that the records should cover from five to ten years, or for some streams twenty years or more, the limit being determined by the relative importance of the stream and the interdependence of the results and other long-time records on adjacent streams.

In the performance of this work the Geological Survey endeavors to approach as nearly as possible the highest degree of precision which a rational expenditure of time and a judicious expenditure of a small amount of money will allow. In all engineering work there is a point of refinement beyond which it is needless and wasteful to proceed, and this principle applies with especial force to stream-flow measurements. It is confidently believed that with some unavoidable exceptions the stream-flow data presented in the publications of the Survey are sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of many stations. All persons are cautioned to exercise the greatest care in the utilization of such incomplete records.

Records of varying lengths have been obtained at about 1,400 different points in the United States, and in addition the surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1907 and 1908 regular gaging stations were maintained by the Survey and cooperating organizations at about 740 points in the United States, and in addition numerous miscellaneous measurements were made. Data were also obtained in regard to precipitation, evaporation, storage reser-

voirs, river profiles, and water power in many sections of the country. These data will be made available in the regular surface water-supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

Among the purposes for which the results contained in this volume are requisite are navigation, irrigation, domestic water supply, water power, swamp and overflow land drainage, and flood prevention The demands of all these interests are immediate.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $42,000,000 on federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system is based absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are of first importance in the redemption of the lands, as well as constituting an insurance of federal and private investments.

Domestic water supply.—The highest use of water is that of domestic supply, and while the federal interest in this aspect of the matter is less direct than in the aspects already named, this use of water nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The time is rapidly approaching when the development of the water power of the country will be an economic necessity. Our stock of coal is being rapidly depleted and the cost of steam power is increasing accordingly. Industry will cease its growth if cheap power is not available, and in that event the United States as a nation will cease to progress. Water power is the only avenue now open. When the electric transmission of power was accomplished, the relation of our water powers to national economy changed entirely. Previous to the day of electric transmission the importance of a water power was largely confined to the locality at which it was generated, but it has now become a public utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available is dependent on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worth-

less, or of precarious value, by reason of overflow and swamp conditions. When this land is drained it becomes exceedingly productive and its value increases many fold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the first consideration in connection with drainage projects. If by the drainage of a large area into any particular channel that channel becomes so gorged with water that overflow conditions are created in places not previously subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States exceeds $100,000,000 annually, and in the year 1908 the aggregate damage, based on reliable data, approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications has varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1907 and 1908. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water-supply of the United States, 1907–8.

Part.	No.	Title.	Part.	No.	Title.
I	241	North Atlantic coast.	VI	246	Missouri River basin.
II	242	South Atlantic coast and eastern Gulf of Mexico.	VII	247	Lower Mississippi River basin.
III	243	Ohio River basin.	VIII	248	Western Gulf of Mexico.
IV	244	St. Lawrence River basin.	IX	249	Colorado River basin.
V	245	Upper Mississippi River and Hudson Bay basins.	X	250	Great Basin.
			XI	251	California.
			XII	252	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive and dates also are inclusive so far as the data are available.

Stream-flow data in reports of the United States Geological Survey.

[Ann.=Annual Report; B.=Bulletin; W. S.=Water-Supply Paper.]

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	do	1903.
W. S. 124 to 135	do	1904.
W. S. 165 to 178	do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1908. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1908.

	1899.[a]	1900.[b]	1901.	1902.	1903.	1904.	1905.	1906.	1907–8.
Atlantic coast and eastern Gulf of Mexico:									
New England rivers	35	47	65, 75	82	97	124	165	201	241
Hudson River to Delaware River, inclusive	35	47, (48)	65, 75	82	97	125	166	202	241
Susquehanna River to York River, inclusive	35	48	65, 75	82	97	126	167	203	241
James River to Yadkin River, inclusive	(35), 36	48	65, 75	(82), 83	(97), 98	126	167	203	242
Santee River to Pearl River, inclusive	36	48	65, 75	83	98	127	168	204	242
St. Lawrence River	36	49	65, 75	(82), 83	97	129	170	206	244
Hudson Bay	.....	.....	66, 75	85	100	130	171	207	245
Mississippi River:									
Ohio River	36	48, (49)	65, 75	83	98	128	169	205	243
Upper Mississippi River	36	49	65, 75	83	98, (99)	128, (130)	171	207	245
Missouri River	(36), 37	49, (50)	66, 75	84	99	130, (131)	172	208	246
Lower Mississippi River	37	50	(65), 66, 75	(83), 84	(98), 99	(128), 131	(169), 173	(205), 209	247
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248
Pacific coast and Great Basin:									
Colorado River	(37), 38	50	66, 75	85	100	133, (134)	175, (177)	211, (213)	249, (251)
Great Basin	38, (39)	51	66, 75	85	100	133, (134)	176, (177)	212, (213)	250, (251)
South Pacific coast to Klamath River, inclusive	(38), 39	51	66, 75	85	100	134	177	213	251
North Pacific coast	38	51	66, 75	85	100	135	(177), 178	214	252

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	All stations in Colorado and Great Basin drainages lying in California repeated.
	Great Basin	

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the

basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the mouth of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated above, and in the records for large lakes, where it is often clearer to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.

$1\frac{1}{3}$ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$=net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, rating table, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height and rating tables are omitted and a table of daily discharge is substituted. For stations where the flow is computed by shifting-channel methods, a table of daily discharge is given in place of rating tables, which are not used in these methods of computation.

In addition to statements regarding the location and installation of current-meter stations the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also full information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with suitable footnotes. The rating is not applicable for such periods unless the proper correction to the gage heights is known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which the rating tables and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is published to enable engineers to determine the daily discharge by its application to the table of gage heights or to check results in the table of monthly discharge.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the period when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 11, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir or dam; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $V=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions. It is seldom used by the United States Geological Survey. For full information regarding the method the reader is referred to the various text-books on hydraulics.

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of sharp-crested and broad-crested weirs within the limits for which

accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, crest which is not level, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general, records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current-meter gaging stations under unobstructed channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.

The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200)[a] and in the various text-books on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The edition of this water-supply paper is exhausted. It can, however, be consulted at most of the larger libraries of the country or can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 20 cents. Remittances must be made by postal money order, express order, or New York draft.

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently but which do not cause a variation of more than about 5 per cent in the discharge curves from year to year; and (4) those with constantly shifting beds. In determining the daily flow different office methods are necessary for each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy.

[a] Water-Supply Paper 200 is a revision of No. 150, the edition of which is exhausted.

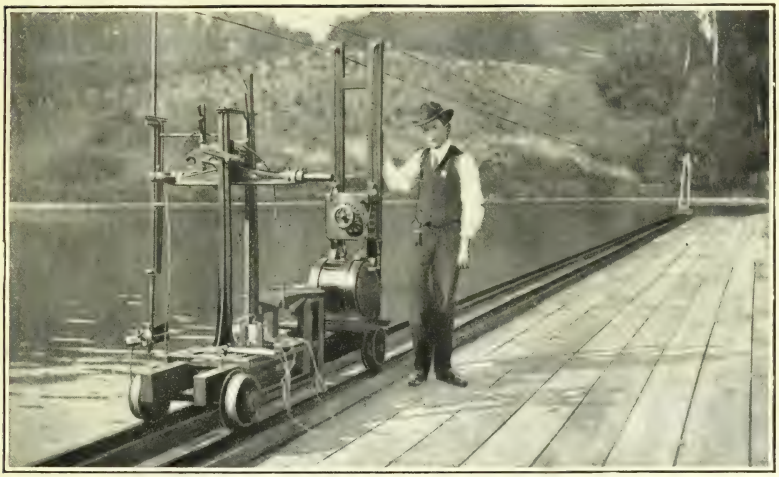
They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years unless funds are available to cover all changes in conditions of flow. A straight, smooth section without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the cost of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 2 to 5 per cent or less of the total width, will within reasonable limits yield better results for a given outlay of money than semipermanent or shifting sections with smooth, uniform current. So far as possible, stations are located where the banks are high and not subject to overflow at high stages and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

In making a measurement with a current meter a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *B*.) These points are spaced equally for those parts of the section where the flow is uniform and smooth and are spaced unequally for other parts according to the discretion and judgment of the engineer. In general the points should not be spaced farther apart than 5 per cent of the distance between piers, nor farther apart than the approximate mean depth at the time of measurement.

The measuring points divide the total cross section into elementary strips at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total discharge of the stream. (For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.)



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.

B. BRIDGE STATION AND CROSS SECTION OF STREAM.

Illustrating 0.2 and 0.8 depth method.

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method with its various modifications of surface, subsurface, and tube or rod floats is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity. For further information regarding this method the reader is referred to Water-Supply Paper 95 and to the various text-books covering the general subject of stream flow.

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions. Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations. On the sides the same type of meter is shown equipped for wading measurements to record by the acoustic method on the left and by the electric method on the right. Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The number of revolutions is indicated electrically. The rating, or relation between the velocity of the moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. (See Pl. I, *A*.) From these data a rating table is prepared which gives the velocity per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per

second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

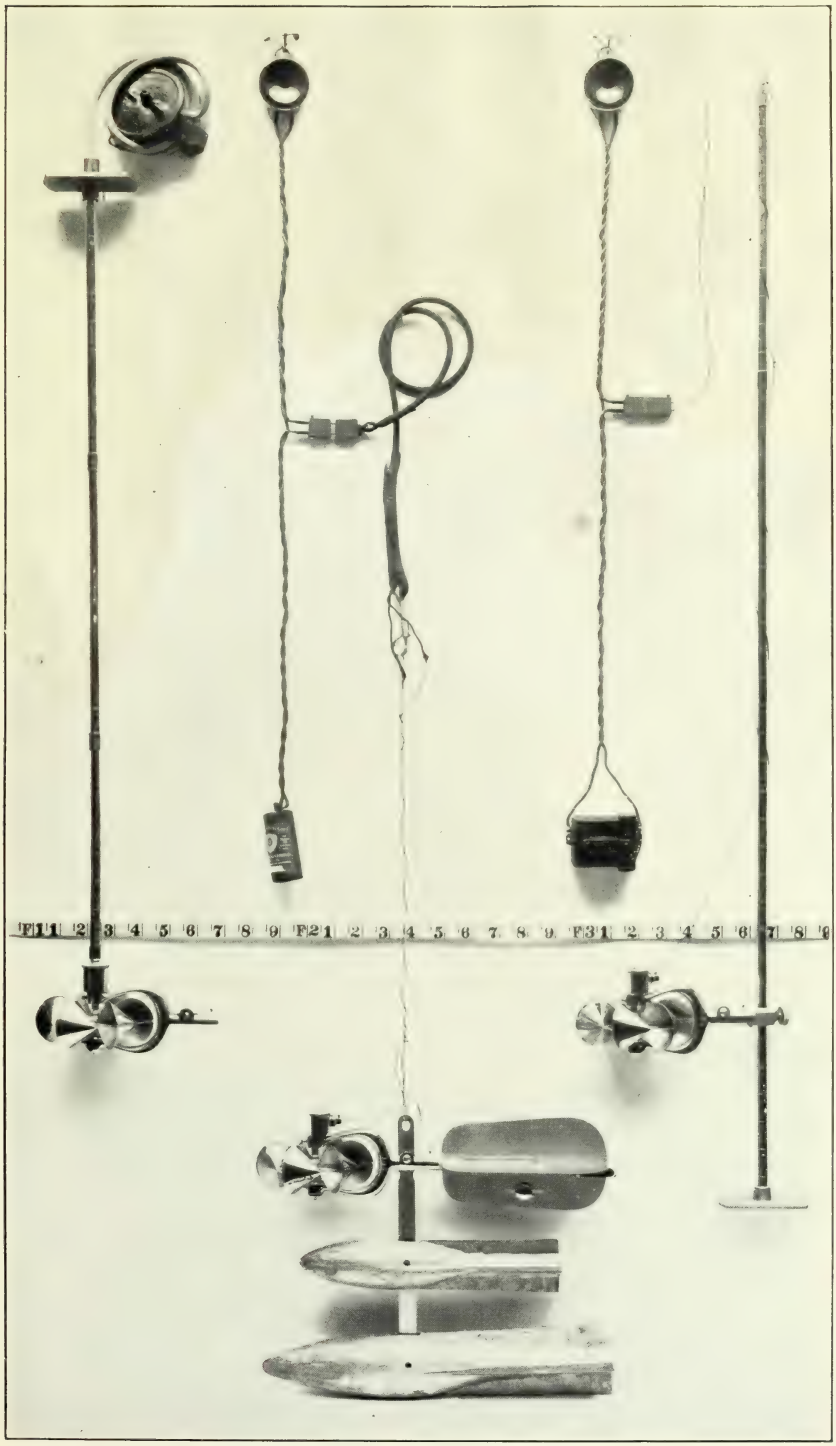
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By platting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from



PRICE PENTA-RECORDING CURRENT METERS.

unity in individual cases is, however, greater than in the 0.2 and 0.8 methods and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper 187.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 17.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are more or less generally parabolic in form. In many cases curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every published rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating as stated in the footnote of each table is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean-discharge curve and the rating developed from that curve represents a very high degree of accuracy. For illustrative example of a station of this type see Water-Supply Paper 241.

Class 2 is confined mainly to stations on rough mountainous streams with steep slopes. (See fig. 1.) The beds of such streams are as a rule comparatively permanent during low and medium stages and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom pos-

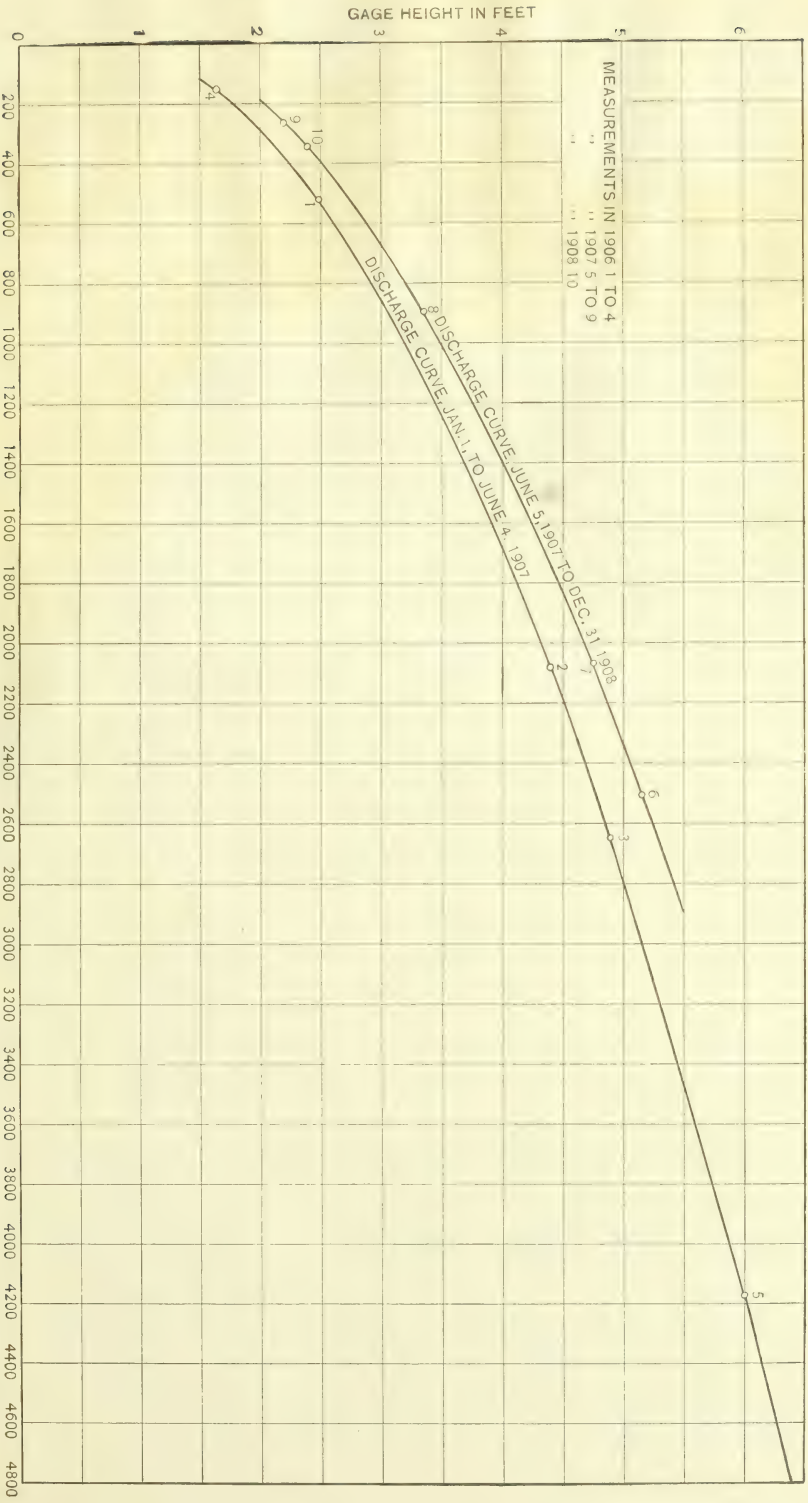


FIGURE 1.—Discharge curves for Weber River near Croydon, Utah.

sible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if, after a change caused by high stage, a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to their ordinates, or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but with few exceptions answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is of course fundamentally due to change in the channel caused by cut, or fill, or both, at and near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky controlling point, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity, which tend to produce a new parallel discharge curve, may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class. For description of a station of this class see Water-Supply Paper 242.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be

modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. For illustrative example of a station of this type, showing the Bolster method of determining the daily discharge graphically, see Water-Supply Papers 247 and 249.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as is feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the monthly discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions wherever available, daily records of temperature and precipitation obtained from the United States Weather Bureau climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all, and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are as a rule included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods,

usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the rating tables and an accuracy column is inserted in the monthly discharge table. In the rating tables "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the Survey engineers. This is done to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for five or ten year periods or

more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates. This is particularly true of the maximum and minimum figures, which in the very nature of the method of collecting these data are liable to large errors. The maximum value should be increased considerably for many stations in considering designs for spillways, and the minimum value should be considered for a group of, say, seven days and not for one day.

The rating table, provided the engineer accepts it, is published primarily to allow him to apply it directly to the daily gage heights and rearrange the daily discharges in order of magnitude or by some other method.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered and records furnished by the United States Reclamation Service, which bears the expense of maintenance of stations on Spanish Fork, Truckee, and Carson rivers, and by the following persons, to whom special acknowledgment is due: Caleb Tanner, state engineer of Utah; Henry Thurtell and F. R. Nicholas, state engineers of Nevada; and the Telluride Power Company.

DIVISION OF WORK.

The field data in the Great Basin drainage area in Utah, Nevada, and Idaho were collected under the direction of E. C. LaRue, district engineer, assisted by A. D. Williams, E. A. Porter, G. T. Burridge, and M. B. Kennedy. The field data in Oregon were collected under the direction of J. C. Stevens, district engineer. The ratings, special estimates, and studies of the completed data were made by F. F. Henshaw and E. C. LaRue. The computation and preparation of the completed data for publication were made under the direction of F. F. Henshaw, assisted by H. D. Padgett, G. L. Parker, G. C. Stevens, R. C. Rice, J. G. Mathers, and E. S. Fuller. The manuscript has been edited by Mrs. B. D. Wood.

GENERAL DESCRIPTION OF THE GREAT BASIN.

In the interior of the North American Continent, west of the Rocky Mountains, is an immense area known as the Great Basin, the streams of which do not discharge to the ocean. The area is not one single drainage basin, but consists rather of a number of basins, some of which are connected and others closed; the outer rim of all, however, is at such an elevation that the region as a whole has no surface outlet.

In outline the Great Basin is rudely triangular. It is bordered on the west by the Sierra Nevada, on the north by the Columbia pla-

teaus, on the east by the Rocky Mountains and the Colorado plateaus, and the southern extremity extends almost to the Gulf of California. This inclosed area is approximately 800 miles long from north to south, 500 miles broad at its widest part, and has been estimated to include 208,000 square miles. It comprises the western part of Utah, almost all of Nevada, and contiguous parts of Idaho, Oregon, and California.

Topographically this interior drainage area is characterized by isolated, narrow mountain ranges, trending north and south and separated by broad valleys varying considerably in altitude. In the southern part the valleys are low, Death Valley being below sea level; in the north the valleys have a general elevation of 4,000 to 5,000 feet. Many of the intervening highlands rise several thousand feet above their bases, and some of the peaks of the bordering ranges attain elevations of 13,000 feet above sea level.

Upper branches of the intermontane valleys extend into the interior ranges as narrow drainage ways that are dry during most of the year; but the drainage from the high mountains on the east and west borders of the basin passes through deep canyons into the broad valleys, where the perennial streams maintain lakes. Among these are Great Salt, Utah, and Sevier lakes in the eastern part, and Pyramid, Winnemucca, Honey, Walker, Mono, and Owens lakes in the western part of the Great Basin. Except Utah Lake, which discharges by Jordan River into Great Salt Lake, these lakes are saline in character, as a consequence of the concentration of salts due to evaporation. Bear Lake in the mountains of the eastern border, and Lake Tahoe, in the Sierra, are large bodies of fresh water that drain, respectively, to Great Salt and Pyramid lakes. Shallow, temporary bodies of water accumulate in some of the broad intermontane valleys during the wet season but completely evaporate during the summer, leaving muddy plains called playas.

Geologically the Great Basin is well known as the type region of the "basin-range structure." Many of the isolated narrow mountain ranges that trend north and south are steep on one side, exposing cross sections of the rocks, and sloping on the other, conforming with the dip of the strata. These ranges have been uplifted by movements of the earth's crust which have broken it into tilted blocks. The greatest displacements of the Great Basin are associated with the eastern and western borders, the Wasatch Mountains and the Sierra Nevada having been uplifted many thousand feet. The mountains of the Great Basin are commonly composed of Paleozoic strata, often modified by volcanism, and the products of weathering and disintegration of these rocks have accumulated in the broad intervening valleys which are strewn to great depths with unconsolidated débris.

The climate of the Great Basin is extremely arid, and except in a few favored spots where irrigation is practiced the region in general is

a desert. Over the larger part of the area the precipitation is less than 10 inches, but it is greater on the bordering highlands, especially on the Sierra Nevada, where it is over 40 inches. The temperature varies widely, owing to the large extent of the area and to differences in elevation. Over most of the region the heat of the summer days is intense, but the diurnal variation is considerable. Evaporation is enormous. From the surface of the water in the vicinity of Salt Lake City it amounts to about 60 inches in a year, and over the major part of the Great Basin it is much greater, amounting in places to possibly 150 inches.

An arid climate, however, has not always prevailed in this region. In late geologic time (early Quaternary) the bordering high mountains supported glaciers and enormous lakes, the old shore lines of which are now plainly marked on the sides of many valleys, accumulated in the Great Basin. The two largest of these lakes have been named after early explorers. Lake Bonneville occupied a considerable part of western Utah, its shrunken remnants being represented by Sevier, Utah, and Great Salt lakes; and Lake Lahontan covered an immense area in western Nevada.

The chief rivers of the Great Basin rise in the mountains which form its eastern and western borders and receive their principal supply from melting snow. The nature of the stream discharge is characteristic; the maximum commonly occurs in late spring or early summer, after which the flow decreases, reaching a minimum during the winter months. After leaving the mountains the streams receive little or no increment; in the broad, waste-filled valleys evaporation and seepage cause diminution in size, and often they entirely cease to flow.

For convenience of treatment the drainage of the Great Basin has been divided into four areas, viz, Wasatch Mountains, Humboldt Sink, Sierra Nevada, and Great Basin drainage in Oregon. The data collected in these areas during 1907 and 1908 are given in the following pages.

WASATCH MOUNTAINS DRAINAGE AREA.

PRINCIPAL STREAMS.

The Wasatch Mountains drainage area includes the western half of Utah and small portions of Idaho and Wyoming. The various streams head either in the Wasatch Mountains or in the plateaus to the south, and discharge into Great Salt Lake or Sevier Lake. The following are the principal rivers of the area:

Bear and Weber rivers, discharging into Great Salt Lake.

City, Parleys, Emigration, Mill, and Big and Little Cottonwood creeks, tributary to Jordan River and thus to Great Salt Lake. These creeks have small drainage areas, but in their mountain courses maintain perennial flows. On reaching the main valley they are exten-

sively used for irrigation, and the first three furnish the chief water supply for Salt Lake City.

American Fork, Hobble Creek, Spanish Fork, and Provo River, discharging into Utah Lake.

Sevier River, with its tributary San Pitch River, draining into Sevier Lake.

BEAR RIVER BASIN.

DESCRIPTION.

Bear River rises on the northern slope of the Uinta Mountains, in the northeastern part of Utah, and after a circuitous course—in which it leaves Utah and enters Wyoming, reenters Utah, appears again in Wyoming, and makes a long detour in Idaho—it returns to Utah and finally discharges its waters into Great Salt Lake. The maximum elevation of the upper rim of the basin is 13,000 feet.

In the upper part of its course, above the Dingle gaging station, the country is rough and broken, the rocks of the extreme headwater regions being principally sandstone and quartzite covered with a thin layer of soil, which supports scattered groves of fir and aspen. Farther down the prevailing formation is a compact limestone covered with a clayey soil, generally dry and with a rank growth of sagebrush. The tributary streams are numerous and well distributed, but most of them are short and confined to steep, narrow canyons. The basin contains no marshes, extensive meadows, or forests, but a few small lakes lie near the head of the river. The greater part of the precipitation is in the form of snow. Numerous small springs and the melting snow are the chief sources of supply of the streams. The annual high-water period occurs during May and June, and the stream is not subject to quick floods or freshets.

Just below Dingle the main stream passes through the north end of Bear Lake valley in a well-defined channel with no overflow, and from this point to Preston it is confined largely to a steep-walled canyon, interrupted by occasional short, narrow valleys containing irrigated farms. The tributaries in this portion of the basin are few, the principal ones being Mink and Cottonwood creeks. About 10 miles below Dingle the outlet to Bear Lake joins the river. This is a small, crooked, sluggish stream that discharges but little water at any time, though it is the only visible outlet to Bear Lake, which has an area of about 144 square miles.

The total unappropriated flow between Dingle and Preston is used for irrigation. There is no storage on the main stream, but on Mink Creek a number of small storage reservoirs are contemplated or in process of construction, the water to be diverted for the irrigation of lands in the northwest end of Cache Valley.

Between Preston and Collinston the Bear flows sluggishly along the west side of Cache Valley in a well-defined channel, and during

extreme floods overflows slightly and covers a very narrow strip immediately along the river. The principal tributary streams in this portion of the course are Cub Creek and Logan River. Cub Creek rises in the Bear River Range and drains a rough limestone country with but little overlying soil. The creek is confined to a steep, narrow canyon until it reaches Cache Valley, where it flows sluggishly for about 15 miles through a winding, but well-defined, channel into Bear River. It discharges considerable water into the main stream during flood and winter seasons, but its entire summer flow is used for irrigation in the north end of Cache Valley. A gaging station was maintained during a part of 1900 and 1901 on Cub Creek about 4 miles northeast of Franklin, at the mouth of the canyon, but owing to unfavorable conditions it was discontinued.

Logan River enters the Bear about 7 miles above the gaging station at Collinston, a short distance above the point where it leaves Cache Valley and enters the canyon.

Practically the only inflow to the Bear in Cache Valley is from seepage and springs. The lower portions of the valley form an artesian basin containing numerous small, flowing wells. The water table lies very near the surface, and during the early spring the lower lands are largely swamp.

The Bear River Canal Company diverts the entire summer flow of the stream above Collinston onto agricultural lands lying on both sides of the river below Bear River canyon. This system has a capacity of 1,000 second-feet, and during the winter and flood seasons a part of the water is used to develop electric power at a point about one-fourth mile above the Collinston station and is returned to the river at Collinston. From 10 to 30 second-feet reaches the stream through leaks and as seepage from the diversion canals.

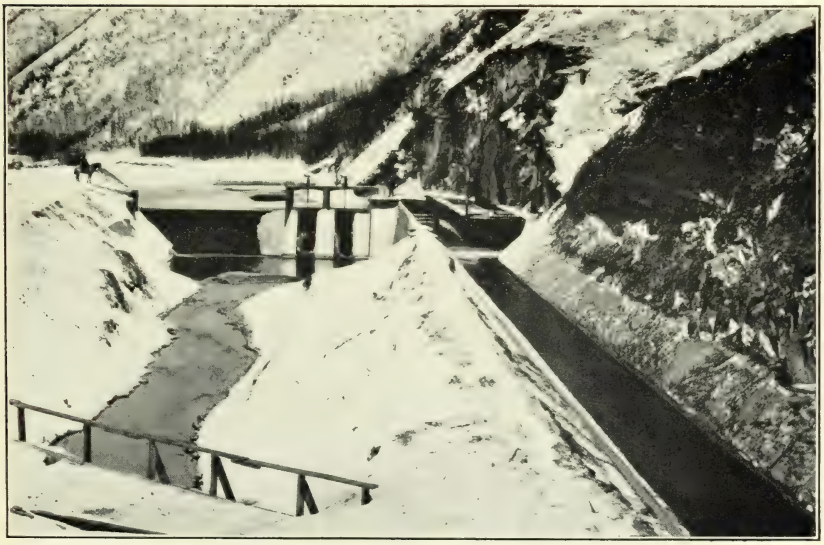
Owing to the complete control of the stream by irrigation works the discharge is liable to extreme variation at any period.

Within the periods for which records are available the wettest year was 1907, the run-off at Collinston in the year being 2,680,000 acre-feet; in 1890, 1894, 1897, 1899, and 1907 the run-off was also high, the total for each of these years exceeding 2,000,000 acre-feet. The driest year was 1905, when the run-off at Collinston, Utah, was only 701,000 acre-feet.

Gaging stations have been maintained in this basin as follows:

Bear River at Dingle, Idaho, 1903–1908.
Bear River near Preston, Idaho, 1889–1908.
Bear River near Collinston, Utah, 1889–1908.
Bear Lake at Fishhaven, Idaho, 1904–1906.
Cub Creek near Franklin, Idaho, 1900–1901.
Logan River near Logan, Utah, 1896–1908.
Logan, Hyde Park, and Smithfield canal, 1904, 1906–7.
Blacksmith Fork near Hyrum, Utah, 1900–1908.
Blacksmith Fork power plant race near Hyrum, Utah, 1904–1908.

A. VIEW AT HEAD OF PROPOSED DIVERSION CANAL FROM BEAR RIVER TO BEAR LAKE, IDAHO.



B. HEADWORKS OF POWER CANAL ON SPANISH FORK, STRAWBERRY VALLEY PROJECT, UTAH.

BEAR RIVER AT DINGLE, IDAHO.

This station, which was established May 9, 1903, to determine the discharge available for storage in Bear Lake, is located about 10 miles above the outlet of Bear Lake, below the proposed intake of the diversion canal to the lake (see Pl. III, *A*), and above all important diversions.

The station is situated in a cut-off built by the Oregon Short Line Railroad Company. Measuring conditions are excellent, the channel is fairly permanent, and records for the open-water season are very reliable. The river is frozen over from about December 1 until the middle or last of March, the ice gradually increasing to a thickness of about 1.2 feet. No anchor or needle ice forms and fairly accurate estimates of discharge during the frozen period can be made. These estimates are specially important, as in the winter season all the water is available for diversion into Bear Lake.

Discharge measurements of Bear River at Dingle, Idaho, in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 25	A. D. Williams	126	676	7.90	3,110
July 12	do	126	679	7.95	3,140
July 29	do	119	433	6.25	1,460
Aug. 24	do	112	265	4.80	480
September 28	La Rue and Williams	111	251	4.62	412

NOTE.—No discharge measurements were made during 1908.

Daily gage height, in feet, of Bear River at Dingle, Idaho, for 1907 and 1908.

[M. K. Hopkins, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.1	4.6	5.9	5.5	6.9	8.75	7.9	5.9	5.0	.....	.....	5.0
2	4.0	4.6	5.8	5.5	7.0	8.7	7.8	5.8	.....	4.65	4.6	4.45
3	4.05	4.6	5.5	5.6	7.1	8.65	7.7	5.7	4.95	4.6	4.6	5.1
4	4.0	4.7	5.3	5.75	7.1	8.6	7.7	5.7	4.95	4.6	4.6	4.7
5	4.05	4.8	5.15	6.1	7.1	8.6	7.7	5.6	4.95	4.6	4.6	4.6
6	4.1	4.9	4.85	6.4	7.0	8.5	7.8	5.6	4.95	4.6	4.6	4.5
7	4.1	4.95	4.9	6.45	7.0	8.5	7.85	5.6	4.9	4.6	4.6	4.55
8	.....	5.0	4.9	6.5	7.1	8.5	7.9	5.5	4.9	4.6	4.6	4.5
9	4.1	5.0	5.1	6.55	7.1	8.6	7.9	.....	4.9	4.6	4.55	4.5
10	4.8	5.0	4.85	6.6	7.2	8.6	7.95	5.3	4.9	4.6	4.5	4.5
11	4.5	5.0	4.85	6.6	7.2	8.6	7.9	5.3	4.85	4.6	4.5	4.5
12	4.3	5.0	5.2	6.7	7.35	8.6	7.95	5.2	4.8	4.6	4.5	4.5
13	4.4	5.1	4.9	6.9	7.6	8.6	8.0	5.2	4.8	4.6	4.5	4.5
14	4.5	5.1	4.85	7.1	7.8	8.6	8.0	5.1	4.8	4.65	4.5	4.3
15	4.5	5.1	5.4	7.3	8.0	8.65	8.0	5.0	4.7	4.65	4.5	4.4
16	4.4	5.0	5.0	7.5	8.0	8.65	8.1	5.0	4.7	.....	4.5	4.6
17	4.4	4.9	4.6	7.6	7.9	8.6	8.0	.....	4.7	.....	4.5	4.3
18	4.4	4.9	4.55	7.8	7.95	8.5	7.9	4.95	4.65	4.6	4.45	4.7
19	4.35	5.0	4.7	7.9	8.0	8.35	7.8	.....	4.65	4.6	4.3	4.65
20	4.3	5.05	4.9	7.9	8.1	8.3	7.55	4.85	4.65	4.6	4.5	4.6
21	4.4	5.05	5.6	7.75	8.3	8.2	7.1	.....	.....	4.6	4.4	4.7
22	4.3	5.0	6.0	7.55	8.4	8.05	6.85	4.8	4.65	4.6	4.5	4.75
23	4.35	5.1	6.5	7.2	8.5	7.9	6.8	4.8	4.65	4.6	4.45	.....
24	4.4	5.1	6.8	7.1	8.6	7.9	.....	4.8	4.6	4.6	4.2	4.7
25	4.4	5.1	7.0	7.0	8.7	7.9	6.6	4.8	4.6	4.6	4.55	4.7

Daily gage height, in feet, of Bear River at Dingle, Idaho, for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	4.5	5.2	7.0	6.9	8.75	7.9	6.5	4.8	4.6	4.6	4.5	4.8
27	4.5	5.6	6.75	6.8	8.7	7.9	6.4	.....	4.6	4.6	5.0	4.8
28	4.5	5.75	6.5	6.8	8.7	7.9	6.3	4.8	4.6	4.6	5.1	4.8
29	4.5	.....	6.2	6.8	8.6	7.9	6.25	4.8	4.65	4.6	3.7	4.8
30	4.55	.....	6.0	6.8	8.6	7.9	6.1	4.8	4.6	4.6	4.1	4.85
31	4.55	.....	5.7	.....	8.7	.....	6.0	4.9	.....	4.6	.....	4.8
1908.												
1	4.8	5.1	.....	4.9	4.9	4.35	5.9	4.35	4.3	4.25	4.4	4.4
2	4.8	.....	.....	4.6	4.9	4.4	5.8	4.35	4.3	4.3	4.4	4.3
3	4.8	.....	5.2	4.75	4.9	4.4	.....	.....	4.3	4.35	4.4	4.35
4	4.8	.....	.....	4.7	4.9	4.5	5.5	4.3	4.3	4.4	4.4	4.4
5	4.85	5.1	.....	4.7	4.9	4.5	5.5	4.4	4.3	4.4	4.4	.....
6	.....	.....	.....	4.7	4.95	4.5	5.5	4.5	4.3	4.45	4.4	4.45
7	4.9	.....	5.25	4.7	5.1	4.5	5.4	4.45	4.25	4.45	4.4	4.4
8	4.9	5.1	.....	4.7	5.0	4.6	5.4	4.4	4.25	4.45	4.4	4.4
9	4.9	.....	.....	4.8	5.0	4.75	5.2	4.4	4.25	4.45	4.4	4.4
10	4.9	.....	5.1	4.8	5.1	4.75	5.1	4.35	4.25	4.45	4.35	.....
11	4.95	.....	.....	4.9	5.1	4.75	5.1	4.4	4.2	4.45	.....	4.4
12	4.95	5.2	.....	4.9	5.1	4.8	5.05	.....	4.2	4.45	4.3	4.45
13	.....	.....	.....	4.9	5.1	4.8	4.95	4.4	4.2	4.4	4.1	4.5
14	5.0	.....	5.0	5.0	4.95	4.8	4.9	4.4	.....	4.4	[a] 3.7	.....
15	5.0	5.1	.....	5.1	4.9	5.1	4.8	4.4	4.2	4.5	[a] 3.8	4.4
16	.....	.....	.....	5.1	4.8	5.5	4.75	4.4	4.15	4.5	4.5	4.45
17	.....	5.2	.....	5.2	4.75	5.75	4.7	4.4	4.15	4.5	4.35	4.4
18	.....	.....	5.5	5.2	4.7	6.0	4.65	4.35	4.15	4.5	4.5	4.45
19	5.0	5.2	6.0	5.2	4.6	6.3	4.6	4.5	4.15	4.5	4.0	.....
20	.....	.....	6.0	.....	4.6	6.5	4.6	4.4	4.15	4.5	4.0	4.3
21	.....	.....	6.1	5.25	4.5	6.6	4.6	4.35	.....	4.5	4.4	4.45
22	5.1	5.1	6.0	5.25	4.45	6.5	4.6	4.35	4.15	.....	4.3	.....
23	.....	.....	5.8	5.3	4.4	6.35	4.6	4.35	4.15	4.4	4.35	4.5
24	.....	.....	5.4	5.3	4.5	6.45	4.6	4.4	4.15	4.5	4.3	4.5
25	5.0	.....	5.3	5.3	4.3	6.1	4.55	4.4	4.15	4.45	4.3	.....
26	.....	.....	5.1	5.25	4.45	6.15	4.55	4.4	4.2	4.4	.....	4.6
27	.....	5.15	5.0	5.2	.....	6.05	4.5	4.4	4.2	.....	4.3	4.6
28	.....	.....	5.0	5.1	4.45	6.0	.....	4.4	4.2	4.4	4.3	.....
29	5.1	5.2	5.0	5.0	4.45	5.95	4.4	4.4	4.2	4.4	.....	4.65
30	.....	.....	4.95	4.95	4.4	.....	.....	4.3	.....	4.4	4.3	4.65
31	.....	.....	4.9	.....	4.3	.....	4.4	4.3	.....	4.4	.....	.....

[a] River probably blocked with ice above gaging station, thus shutting off the water and releasing it in the two or three days following.

NOTE.—The river was frozen over January 1 to March 9, 1907; the ice increased in thickness from 0.6 foot, January 6, to 1.2 February 7 to 22; decreased to 0.6 foot March 7, and was gone March 18. Ice conditions November 25 to 28, 1907, and from about December 18, 1907, to March 17, 1908; the ice reached a maximum thickness of 1.2 feet February 1 to 15, 1908. River began to freeze November 14, 1908, but probably was not frozen over until about December 20.

Rating tables for Bear River at Dingle, Idaho.

JANUARY 1, 1904, TO MAY 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	160	4.60	540	5.60	1,085	6.60	1,910
3.70	190	4.70	590	5.70	1,155	6.70	2,000
3.80	225	4.80	635	5.80	1,230	6.80	2,090
3.90	260	4.90	685	5.90	1,300	6.90	2,180
4.00	295	5.00	740	6.00	1,375	7.00	2,275
4.10	330	5.10	790	6.10	1,460	7.20	2,455
4.20	370	5.20	840	6.20	1,550	7.40	2,635
4.30	410	5.30	895	6.30	1,640	7.60	2,815
4.40	455	5.40	955	6.40	1,730	7.80	2,995
4.50	495	5.50	1,020	6.50	1,820	8.00	3,175

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 14 discharge measurements made during 1903–1906 and is well defined between gage heights 3.5 feet and 7.4 feet. Above gage height 6.1 feet the rating curve is a tangent, the difference being 90 per tenth.

Rating tables for Bear River at Dingle, Idaho—Continued.

MAY 16, 1907, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	106	4.80	482	5.90	1,180	7.00	2,120
3.80	128	4.90	534	6.00	1,250	7.20	2,320
3.90	153	5.00	590	6.10	1,330	7.40	2,520
4.00	180	5.10	650	6.20	1,410	7.60	2,740
4.10	210	5.20	710	6.30	1,490	7.80	2,960
4.20	242	5.30	770	6.40	1,570	8.00	3,180
4.30	276	5.40	830	6.50	1,660	8.20	3,400
4.40	312	5.50	900	6.60	1,750	8.40	3,630
4.50	350	5.60	970	6.70	1,840	8.60	3,870
4.60	390	5.70	1,040	6.80	1,930	8.80	4,110
4.70	434	5.80	1,110	6.90	2,020		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1907, and is well defined between gage heights 4.6 feet and 8.0 feet.

Monthly discharge of Bear River at Dingle, Idaho, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	430	175	234	14,400	C.
February	750	240	392	21,800	C.
March	2,280	450	1,040	64,000	B.
April	3,080	1,020	2,130	127,000	A.
May	4,050	2,180	3,090	190,000	A.
June	4,050	3,070	3,600	214,000	A.
July	3,290	1,250	2,550	157,000	A.
August	1,180	482	689	42,400	A.
September	590	390	468	27,800	A.
October	412	390	393	24,200	A.
November	390	106	316	18,800	B.
December	650	276	351	21,600	C.
The year	4,050	106	1,270	923,000	
1908.					
January	330	250	290	17,800	C.
February	320	285	298	17,100	C.
March	1,250	250	587	36,100	B.
April	770	390	596	35,500	A.
May	650	276	466	28,700	A.
June	1,750	294	859	51,100	A.
July	1,180	312	576	35,400	A.
August	350	276	306	18,800	A.
September	276	226	246	14,600	A.
October	350	259	324	19,900	A.
November	350	106	276	16,400	B.
December	350	220	292	18,000	C.
The year	1,750	106	426	309,000	

NOTE.—The discharges for ice periods were determined as follows: For February, 1907, an ice rating table was used, based on measurements in 1904 to 1906 under ice conditions similar to those existing in February, through ice 1 to 1.2 feet thick. For January and March 1 to 9, discharges were estimated by a transition between this table and that for the open channel periods before and after, taking into account the thickness of ice. November 25 to 28 were interpolated on account of slush ice. For January 19 to March 14, 1908, an ice table was used, parallel with respect to gage height to that used in February, 1907, and 0.35 foot higher, this being the amount that the 1908 open water rating plots above that for the period before the high water of 1907. December 18, 1907, to January 18, 1908, estimated by transition between open water and ice tables; March 15 to 17 interpolated. For December 21 to 31, ice has been assumed to be 0.5 foot thick.

BEAR RIVER NEAR PRESTON, IDAHO.

This station, which is situated at the upper end of Cache Valley, about 6 miles from Preston, Idaho, and 10 miles north of the Idaho-Utah state line, has been maintained continuously since October 11,

1889. The records are necessary to determine the amount of water passing from Idaho into Utah and will be of value in the final adjudication of water rights.

Cub Creek and Logan River enter the Bear in the valley below the station. Few diversions are made above, but large areas of irrigable land are available. It is possible to divert the river from a point near Soda Springs, at the north end of the Bear River Range, over the divide to lands adjacent to Portneuf River, a tributary of the Snake.

More or less ice forms at this station for two or three months during the winter. The river seldom freezes over, but when the morning gage readings show the effect of anchor and slush ice the afternoon readings have been used. The channel shifts slightly during floods but measuring conditions are good.

Discharge measurements of Bear River near Preston, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 12	G. T. Burridge	224	1,160	5.70	6,560
June 26	do	216	957	4.90	5,160
July 21	do	202	795	3.82	3,340
August 14	La Rue and Burridge	196	510	2.10	1,280
1908.					
July 23	A. D. Williams	196	372	1.35	675

Daily gage height, in feet, of Bear River near Preston, Idaho, for 1906, 1907, and 1908.

[Mrs. Hannah Nelson and O. M. Seamons, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.[a]												
1	.....	1.30	1.25	2.70	3.20	4.45	2.78	1.38	1.85	1.52	1.52	1.52
2	.....	1.20	1.20	2.70	3.12	4.40	2.68	1.30	1.85	1.50	1.55	1.55
3	.....	1.20	1.20	2.55	2.95	4.40	2.58	1.28	1.85	1.40	1.55	1.62
4	.....	1.20	1.20	2.50	3.00	4.42	2.52	1.22	1.80	1.40	1.55	1.70
5	.....	1.05	1.20	2.58	3.00	4.48	2.50	1.20	1.80	1.40	1.55	1.70
6	2.90	1.20	1.25	2.62	2.95	4.70	2.42	1.15	1.75	1.40	1.55	1.70
7	.....	1.52	1.25	2.90	2.90	4.68	2.32	1.10	1.75	1.40	1.55	1.70
8	.....	1.68	1.25	3.25	2.90	4.58	2.22	1.10	1.75	1.42	1.55	1.70
9	.....	1.40	1.30	3.42	2.90	4.50	2.30	1.05	1.75	1.45	1.55	1.70
10	.....	1.20	1.30	3.60	2.90	4.48	2.28	1.00	1.75	1.45	1.55	1.70
11	.....	1.12	1.30	3.60	2.90	4.38	2.22	1.00	1.75	1.42	1.55	1.70
12	3.00	1.05	1.30	3.40	2.90	4.25	2.18	1.00	1.70	1.40	1.55	1.70
13	.....	1.05	1.30	3.40	3.12	4.12	2.10	.95	1.65	1.40	1.55	1.70
14	.....	1.05	1.30	3.52	3.40	4.05	2.10	.90	1.68	1.40	1.55	1.70
15	.....	1.05	1.30	3.65	3.82	4.00	2.10	.90	1.70	1.40	1.55	1.70
16	.....	1.12	1.30	3.70	3.88	3.95	2.08	.85	1.60	1.40	1.55	1.70
17	.....	1.20	1.35	3.82	3.80	3.85	2.00	.85	1.60	1.40	1.55	1.70
18	.....	1.20	1.35	3.72	3.80	3.80	1.95	.85	1.60	1.40	1.70	1.70
19	.....	1.38	1.60	3.70	3.80	3.72	1.88	.85	1.58	1.40	1.70	1.70
20	1.60	1.35	1.60	3.62	3.80	3.68	1.80	.85	1.55	1.40	1.70	1.70
21	1.60	1.35	1.40	3.60	3.80	3.52	1.75	.90	1.55	1.40	1.70	1.70
22	1.62	1.30	1.40	3.52	3.80	3.32	1.70	.95	1.52	1.40	1.70	1.70
23	1.35	1.25	1.55	3.50	3.80	3.30	1.65	1.25	1.50	1.40	1.70	1.70
24	1.30	1.25	1.90	3.50	3.85	3.30	1.60	1.50	1.50	1.40	1.70	1.70
25	1.25	1.25	2.25	3.45	4.00	3.32	1.60	1.62	1.50	1.40	1.70	1.70

[a] These gage heights supersede those published in Water-Supply Paper 212, p. 23, many of which were in error, the observer having recorded his readings as hundredths of feet instead of tenths.

Daily gage height, in feet, of Bear River near Preston, Idaho, for 1906, 1907, and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
26	1.30	1.25	2.15	3.42	4.20	3.28	1.60	1.68	1.50	1.40	1.70	1.75
27	1.20	1.25	1.90	3.40	4.42	3.18	1.60	1.72	1.50	1.40	1.70	1.80
28	1.20	1.25	1.92	3.32	4.52	3.08	1.58	1.78	1.50	1.40	1.50	1.75
29	1.20	.....	1.95	3.20	4.50	2.98	1.52	1.85	1.55	1.40	1.50	1.72
30	1.20	.....	1.98	3.20	4.60	2.88	1.48	1.85	1.55	1.40	1.50	1.68
31	1.20	.....	2.20	.....	4.52	.....	1.40	1.85	.....	1.40	.....	1.65
1907.												
1	1.6	1.6	2.1	4.1	4.5	4.75	4.5	2.8	1.8	1.8	1.9	1.6
2	1.55	1.65	2.1	4.05	4.5	4.7	4.4	2.8	1.8	1.85	1.85	1.6
3	1.5	1.65	2.15	4.15	4.4	4.7	4.3	2.7	1.8	1.9	1.85	1.65
4	1.5	1.7	2.15	4.3	4.4	4.7	.....	2.6	1.85	1.9	1.85	1.7
5	1.5	1.7	2.2	4.1	4.4	4.8	.....	2.6	1.85	1.85	1.85	1.8
6	1.5	1.7	2.35	4.1	4.4	.....	.....	2.5	1.9	1.85	1.8	1.8
7	1.5	1.7	2.5	4.1	4.4	.....	4.2	2.4	1.9	1.8	1.8	1.85
8	1.5	1.8	2.5	4.1	4.4	.....	4.1	2.4	2.0	1.8	1.8	1.9
9	1.6	1.8	2.5	4.2	4.5	.....	4.0	2.35	2.0	1.8	1.8	1.85
10	1.65	2.0	2.5	4.3	4.55	.....	4.0	2.3	1.95	1.8	1.8	1.7
11	1.7	2.0	2.5	4.5	4.65	.....	4.0	2.2	1.95	1.8	1.8	1.65
12	1.65	1.9	2.4	4.6	4.7	5.7	4.0	2.1	1.9	1.9	1.8	1.65
13	1.6	2.0	2.4	4.65	4.7	.....	4.0	2.3	1.9	1.9	1.8	1.6
14	1.6	2.0	2.4	4.75	4.7	.....	3.9	2.1	1.9	1.9	1.8	1.6
15	1.6	1.9	2.3	4.85	4.7	.....	3.85	2.0	1.9	1.9	1.8	1.6
16	1.6	1.9	2.2	4.9	4.7	.....	3.85	2.0	1.8	1.9	1.8	1.6
17	1.6	1.85	2.45	4.9	4.8	.....	3.85	1.9	1.8	1.85	1.8	1.4
18	1.6	1.85	2.6	4.9	4.95	.....	3.85	1.85	1.8	1.85	1.8	.....
19	1.6	1.85	2.9	4.9	5.15	.....	3.85	1.8	1.75	1.8	1.7	1.2
20	1.65	1.85	3.5	4.9	5.25	5.3	3.8	1.7	1.75	1.8	1.7	1.6
21	1.7	1.85	4.2	5.0	5.3	5.25	3.8	1.7	1.75	1.85	1.7	1.8
22	1.8	2.0	4.15	5.0	5.3	5.2	3.7	1.7	1.8	1.8	1.75	1.85
23	1.5	2.2	4.0	5.0	5.3	5.15	3.5	1.65	1.8	1.8	1.75	1.85
24	1.5	2.0	4.0	5.0	5.55	5.1	3.5	1.6	1.8	1.8	1.75	1.9
25	1.5	2.0	4.15	4.95	5.7	5.05	3.4	1.7	1.8	1.8	1.75	1.95
26	1.5	2.0	4.3	4.8	5.8	4.95	3.3	1.75	1.8	1.8	1.70	2.0
27	1.7	2.0	4.35	4.75	5.8	4.8	3.2	1.8	1.8	1.8	1.70	2.0
28	1.7	2.0	4.5	4.7	5.8	4.7	.....	1.8	1.8	1.85	1.65	1.8
29	1.7	.....	4.45	4.65	5.8	4.6	.....	1.85	1.8	1.85	1.65	1.8
30	1.6	.....	4.3	4.5	5.8	4.6	2.9	1.8	1.8	1.9	1.60	1.8
31	1.6	.....	4.2	.....	5.8	.....	2.9	1.8	.....	1.9	.....	1.75
1908.												
1	1.8	1.7	1.7	2.45	2.3	1.8	2.6	1.3	1.3	.....	1.6	1.5
2	1.8	1.7	1.75	2.3	2.3	1.85	2.5	1.3	1.3	.....	1.6	1.6
3	1.8	1.6	1.8	2.3	2.25	1.9	2.4	1.25	1.3	.....	1.6	1.5
4	1.8	1.45	1.8	2.3	2.2	2.05	2.3	1.2	1.25	.....	1.6	1.65
5	.....	1.5	1.7	2.3	2.2	2.3	2.3	1.05	1.25	.....	1.6	1.65
6	1.8	1.5	1.7	2.4	2.15	2.4	2.15	1.0	1.25	.....	1.6	1.7
7	1.8	1.55	1.7	2.4	2.15	2.5	2.0	.95	1.25	.....	1.6	1.6
8	1.8	1.85	1.65	2.45	2.1	2.6	1.9	.95	1.25	.....	1.3	1.6
9	1.8	1.7	1.65	2.45	2.1	2.6	1.8	.9	1.25	.....	1.6	1.6
10	1.75	1.7	1.7	2.45	2.2	2.65	1.7	.9	1.25	.....	1.6	1.65
11	1.7	1.7	1.7	2.4	2.2	2.7	1.6	.9	1.25	.....	1.6	1.6
12	1.7	1.7	1.75	2.4	2.1	2.7	1.5	.9	1.25	.....	1.6	1.6
13	1.7	1.6	1.8	2.4	2.0	2.8	1.5	.9	1.25	.....	1.6	1.6
14	1.7	1.6	1.85	2.4	1.95	2.8	1.5	.9	1.25	.....	1.5	1.6
15	1.7	1.6	1.9	2.5	.....	2.85	1.45	.9	1.25	.....	1.5	1.6
16	1.65	1.6	2.05	2.5	.....	2.85	1.4	.9	1.2	1.65	1.5	1.6
17	1.6	1.55	2.25	2.55	.....	2.9	1.35	.9	1.2	1.65	1.5	1.55
18	1.6	1.5	2.4	2.55	1.8	2.95	1.35	.9	1.2	1.65	1.5	1.4
19	1.6	1.5	2.5	2.6	1.8	2.95	1.35	.9	1.2	1.7	1.5	1.4
20	1.7	1.5	2.6	2.65	1.75	3.0	1.35	.95	1.2	1.7	1.5	1.35
21	1.7	1.45	2.7	2.7	1.7	3.0	1.35	.95	1.2	1.65	1.55	1.4
22	1.7	1.5	2.85	2.7	1.7	3.0	1.35	.95	1.2	1.65	1.6	1.75
23	1.7	1.55	3.0	2.7	1.35	3.1	1.35	1.0	1.2	1.65	1.6	1.9
24	1.7	1.6	3.1	2.65	1.3	3.0	1.3	1.2	.....	1.65	1.7	2.25
25	1.6	1.6	3.1	2.6	1.4	.....	1.3	1.2	.....	1.65	1.7	2.25
26	1.6	1.6	2.9	2.6	1.6	.....	1.3	1.25	.....	1.6	1.6	2.85
27	1.7	1.7	2.8	2.5	1.75	.....	1.3	1.25	.....	1.6	1.5	2.35
28	1.7	1.7	2.8	2.5	1.8	.....	1.25	1.3	.....	1.6	1.5	1.7
29	1.7	1.7	2.7	2.4	1.8	.....	1.2	1.3	.....	1.6	1.5	1.5
30	1.7	.....	2.6	2.35	1.8	2.7	1.2	1.3	.....	1.6	1.5	1.5
31	1.7	.....	2.6	.....	1.8	.....	1.35	1.3	.....	1.6	.....	1.5

NOTE.—The river is known to have been frozen or the gage heights to have been affected by slush or anchor ice during the following periods: January 1 to 26, February 7 to 9, and November 18 to 27, 1906; December 17 to 24, 1907; February 4 to 9, November 29 to December 3, and December 17 to 27, 1908. There was slush ice in the morning at other times during December to March, but the afternoon readings were unaffected and have been used. There was some obstruction from ice from about January 1 to February 10, 1907, which probably did not materially affect the gage readings.

Rating tables for Bear River near Preston, Idaho.

FOR 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	320	1.80	960	2.80	1,800	3.80	3,150
.90	365	1.90	975	2.90	1,910	3.90	3,310
1.00	415	2.00	1,050	3.00	2,030	4.00	3,470
1.10	465	2.10	1,130	3.10	2,150	4.20	3,830
1.20	520	2.20	1,215	3.20	2,280	4.40	4,140
1.30	575	2.30	1,300	3.30	2,410	4.60	4,480
1.40	635	2.40	1,390	3.40	2,550	4.80	4,820
1.50	695	2.50	1,480	3.50	2,690		
1.60	760	2.60	1,580	3.60	2,840		
1.70	830	2.70	1,690	3.70	2,990		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906 and earlier high water measurements, and is well defined. It supersedes the table for 1906 given in Water-Supply Paper 212, p. 23.

FOR 1907 AND 1908.

0.90	395	2.10	1,160	3.30	2,480	5.00	5,280
1.00	440	2.20	1,240	3.40	2,620	5.20	5,640
1.10	490	2.30	1,330	3.50	2,770	5.40	6,000
1.20	540	2.40	1,420	3.60	2,920	5.60	6,360
1.30	600	2.50	1,520	3.70	3,080	5.80	6,740
1.40	660	2.60	1,620	3.80	3,240	6.00	7,120
1.50	720	2.70	1,730	3.90	3,400	6.20	7,500
1.60	780	2.80	1,840	4.00	3,560	6.40	7,900
1.70	840	2.90	1,960	4.20	3,890	6.60	8,300
1.80	920	3.00	2,080	4.40	4,230	6.80	8,700
1.90	1,000	3.10	2,210	4.60	4,570		
2.00	1,080	3.20	2,340	4.80	4,920		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1906–1908, and is well defined between gage heights 1.2 feet and 6.5 feet.

Monthly discharge of Bear River near Preston, Idaho, for 1905, 1906, 1907, and 1908.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.[a]							
January	650	580	607	0.135	0.16	37,300	C.
February	770	580	650	.144	.15	36,100	C.
March	1,200	580	907	.202	.23	55,800	A.
April	1,020	779	871	.194	.22	51,800	A.
May	1,320	722	991	.220	.25	60,900	A.
June	855	328	599	.133	.15	35,600	A.
July	251	164	201	.045	.05	12,400	A.
August	234	158	176	.039	.04	10,800	A.
September	328	217	250	.056	.06	14,900	A.
October	580	328	490	.109	.13	30,100	A.
November	522	443	495	.110	.12	29,500	A.
December	468	418	423	.094	.11	26,000	C.
The year	1,320	158	555	.123	1.67	401,000	
1906.[b]							
January	520	420	459	0.102	0.12	28,200	D.
February	623	440	522	.116	.12	29,000	C.
March	1,260	520	717	.159	.18	44,100	B.
April	3,180	1,480	2,450	.544	.61	146 000	A.
May	4,480	1,910	2,880	.640	.74	177,000	A.
June	4,650	1,890	3,360	.747	.83	200,000	A.
July	1,780	635	1,090	.242	.28	67,000	B.
August	938	342	545	.121	.14	33,500	B.
September	938	695	796	.177	.20	47,400	B.
October	708	635	642	.143	.16	39,500	B.
November	728	695	719	.160	.18	42,800	B.
December	900	708	824	.183	.21	50,700	C.
The year	4,650	342	1,250	.278	3.77	905,000	

[a] These discharges for 1905 supersede those published in Water-Supply Paper 176, p. 25. Many of the gage heights as given on p. 24 of that report are in error, 1.4 being recorded by observer as 1.04, etc. The same rating table has been used in recomputing.

[b] These discharges supersede those published in Water-Supply Paper 212, p. 24. See footnotes to table of gage heights (p. 34).

Monthly discharge of Bear River near Preston, Idaho, for 1905, 1906, 1907, and 1908—Con.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	920	720	777	0.173	0.20	47,800	C.
February	1,240	780	980	.218	.23	54,400	C.
March	4,400	1,100	2,360	.524	.60	145,000	A.
April	5,280	3,640	4,560	1.01	1.13	271,000	A.
May	6,740	4,230	5,280	1.17	1.35	325,000	A.
June	8,500	4,570	5,800	1.30	1.45	349,000	B.
July	4,400	1,960	3,250	.722	.83	200,000	A.
August	1,840	780	1,170	.260	.30	71,900	B.
September	1,080	880	953	.212	.24	56,700	B.
October	1,000	920	954	.212	.24	58,700	B.
November	1,000	780	897	.199	.22	53,400	B.
December	1,080	540	865	.192	.22	53,200	C.
The year	8,500	540	2,330	.516	7.01	1,690,000	
1908.							
January	920	780	854	0.190	0.22	52,500	C.
February	960	690	783	.174	.19	45,000	C.
March	2,210	810	1,320	.293	.34	81,200	A.
April	1,730	1,330	1,500	.333	.37	89,300	A.
May	1,330	600	1,010	.224	.26	62,100	B.
June	2,210	920	1,730	.384	.43	103,000	B.
July	1,620	540	827	.184	.21	50,800	B.
August	600	395	475	.106	.12	29,200	B.
September	600	540	561	.125	.14	33,400	B.
October	840	600	758	.168	.19	46,600	B.
November	840	720	761	.169	.19	45,300	B.
December	840	630	737	.164	.19	45,300	C.
The year	2,210	395	943	.209	2.85	684,000	

NOTE.—In computing the above discharges the following corrections and estimates have been made: 1905, January 1 to 18, interpolated; February 10 to 20, interpolated with measurement of February 17; December 7 to January 19, 1906, discharge assumed to have remained practically constant at 418 to 420 second-feet; January 27 to 31, 1906, estimated; February 7 to 9, interpolated; November 18 to 27, interpolated. June 6 to 19, 1907, interpolated with aid of hydrograph following rate of rise and fall at Collinston. September 24 to October 15, 1908, and December 22 to 28, 1908, interpolated.

BEAR RIVER NEAR COLLINSTON, UTAH.

This station, which is located 6 miles north of Collinston station, on the Oregon Short Line Railroad, about one-fourth mile below the electric-power plant in Bear River canyon, was established July 1, 1889, and has been kept continuously since that date. From July 6, 1906, to August, 1907, however, only weekly gage readings were obtained.

The station is at the lower end of the canyon separating Cache and Great Salt Lake valleys and is below all diversions from the stream. The records show the amount of unappropriated water discharged into Great Salt Lake. Malade River is the only tributary below this point.

Almost the entire summer flow of the stream in years of low water is diverted by the Bear River Canal Company at a point above the station to agricultural lands on both sides of the river below the canyon. The system has a capacity of about 1,000 second-feet, and during the winter and flood seasons a part of the water is used

to develop electric power above the gaging station and is returned to the river.

Bear River seldom freezes over at this station. During December and January ice forms in a narrow strip along each bank, but does not appreciably affect the determination of discharge.

The stream bed at the section has not changed in several years and records are very reliable. Changes of load at the power plant above and changes in the amount of diversion in canals may, however, cause sudden fluctuations in gage heights.

Discharge measurements of Bear River near Collinston, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	G. T. Burridge	293	1,830	6.60	10,100
June 13	do	280	1,940	7.00	9,710
June 27	do	288	1,650	6.00	7,190
July 19	do	280	1,190	4.15	4,190
August 15	La Rue and Burridge	281	998	3.50	3,120
1908.					
July 24	A. D. Williams	203	252	1.00	526

Daily gage height, in feet, of Bear River near Collinston, Utah, for 1907 and 1908.

[J. L. Sellers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1						6.5			1.5	2.7	2.6	2.5
2		2.2	2.7						1.4	2.8	2.6	2.5
3								3.05	2.4	2.8	2.6	2.5
4					5.55				2.4	2.5	2.6	2.5
5	1.9								2.6	2.4	2.5	2.5
6				5.2			5.25		2.4	2.4	2.5	2.5
7									2.4	2.4	2.5	2.6
8						7.0			2.4	2.4	2.5	2.6
9		3.65	3.35						2.4	2.4	2.5	2.8
10								2.55	2.3	2.4	2.4	2.8
11					5.3	7.2			2.3	2.3	2.4	2.7
12	1.95								2.4	2.3	2.4	2.6
13				5.8		7.0	4.5		2.6	2.3	2.5	2.6
14									2.5	2.3	2.5	2.6
15						6.9		3.5	2.5	2.4	2.6	2.7
16		2.65	3.05					2.1	2.4	2.4	2.6	2.6
17				6.55				2.3	2.3	2.4	2.5	1.9
18				6.6	5.9			2.2	2.1	2.5	2.5	1.7
19	1.85						4.15	2.1	2.0	2.5	2.5	1.6
20				6.45			4.1	2.1	2.0	2.5	2.5	1.5
21								2.0	2.0	2.5	2.5	1.5
22						6.3		2.0	1.9	2.5	2.5	1.9
23		2.75	3.35					1.9	1.9	2.5	2.5	2.4
24					6.6			1.9	1.8	2.5	2.5	2.6
25					6.85			2.0	1.7	2.5	2.5	2.8
26	1.85							2.1	1.6	2.5	2.5	3.0
27				5.8		6.0	3.65	2.0	1.5	2.5	2.5	3.7
28								2.2	2.0	2.5	2.5	3.3
29						5.9		2.3	2.3	2.5	2.5	2.9
30			5.2					1.6	2.5	2.5	2.5	2.4
31								1.5		2.5		2.0

Daily gage-height, in feet, of Bear River near Collinston, Utah, for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.3	1.9	2.9	3.0	2.9	2.9	3.3	1.0	1.2	1.7	2.4	2.0
2	2.5	1.9	2.8	3.0	2.6	3.0	3.1	1.0	1.2	1.7	2.4	2.1
3	2.6	2.0	2.6	2.9	2.5	3.1	2.8	1.2	1.3	1.7	2.3	2.2
4	2.6	2.2	2.6	2.9	2.5	3.3	2.6	1.2	1.3	1.8	2.3	2.2
5	2.1	2.2	2.6	2.9	2.5	3.6	2.5	1.2	1.3	1.9	2.1	2.4
6	2.3	2.4	2.6	2.9	2.3	4.0	2.2	1.2	1.3	2.0	2.0	2.4
7	2.4	2.5	2.6	2.9	2.3	4.0	2.0	1.2	1.3	2.1	1.8	2.4
8	2.4	2.5	2.6	2.9	2.2	4.0	1.8	1.2	1.3	2.2	2.0	2.4
9	2.4	2.4	2.5	2.9	2.2	4.0	1.8	1.2	1.3	2.1	2.0	2.4
10	2.5	2.4	2.5	2.8	2.4	3.9	1.8	1.2	1.3	2.0	2.2	2.4
11	2.5	2.4	2.5	2.8	2.3	3.9	1.8	1.2	1.3	2.0	2.2	2.4
12	2.5	2.5	2.5	2.8	2.3	3.9	1.6	1.2	1.3	2.0	2.3	2.4
13	2.5	2.5	2.6	2.9	2.4	3.9	1.6	1.2	1.3	2.0	2.3	2.4
14	2.5	2.4	2.6	3.0	2.4	4.1	1.6	1.2	1.3	1.95	2.3	2.4
15	2.5	2.4	2.8	3.1	2.3	4.3	1.5	1.2	1.3	2.0	2.3	2.3
16	2.4	2.3	2.9	3.2	2.2	4.5	1.4	1.2	1.4	2.2	2.3	2.3
17	2.4	2.3	3.0	3.3	2.2	4.5	1.2	1.2	1.4	2.3	2.3	2.3
18	2.2	2.4	3.2	3.4	2.2	4.7	1.0	1.2	1.4	2.3	2.3	1.8
19	2.4	2.4	3.3	3.4	2.1	4.7	1.0	1.2	1.4	2.3	2.3	1.4
20	2.5	2.3	3.2	3.4	2.2	4.9	1.0	1.2	1.4	2.35	2.3	1.2
21	2.5	2.2	3.1	3.3	2.3	4.7	1.0	1.3	1.4	2.4	2.3	1.0
22	2.5	2.2	3.2	3.3	2.3	4.5	.8	1.3	1.4	2.4	2.3	1.0
23	2.4	2.3	3.3	3.5	2.2	4.4	.8	1.3	1.4	2.4	2.3	1.0
24	2.4	2.3	3.5	3.6	2.2	4.3	.8	1.3	1.5	2.4	2.3	1.0
25	2.4	2.4	3.6	3.8	2.2	4.1	.8	1.2	1.6	2.35	2.3	1.0
26	2.4	2.4	3.8	3.8	2.3	4.0	.8	1.2	1.6	2.3	2.4	1.0
27	2.4	2.5	3.9	3.7	2.6	3.9	.9	1.2	1.6	2.3	2.4	1.2
28	2.3	2.7	3.9	3.5	2.9	3.7	1.0	1.2	1.6	2.3	2.4	1.6
29	2.4	2.9	3.7	3.3	2.9	3.7	1.0	1.2	1.6	2.3	1.9	2.0
30	2.5	.....	3.4	3.1	2.9	3.5	1.0	1.2	1.6	2.4	1.9	2.2
31	2.5	.....	3.0	.....	2.9	.....	1.0	1.2	.....	2.4	.....	2.3

NOTE.—Bear River seldom freezes over at this station, the only ice being a narrow strip along each bank during December and January.

Rating table for Bear River near Collinston, Utah, for January 1, 1907, to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	385	2.10	1,530	3.40	3,110	5.40	6,320
0.90	440	2.20	1,640	3.50	3,250	5.60	6,680
1.00	500	2.30	1,750	3.60	3,390	5.80	7,040
1.10	570	2.40	1,860	3.70	3,530	6.00	7,400
1.20	645	2.50	1,970	3.80	3,670	6.20	7,800
1.30	725	2.60	2,080	3.90	3,820	6.40	8,220
1.40	810	2.70	2,190	4.00	3,980	6.60	8,660
1.50	900	2.80	2,300	4.20	4,300	6.80	9,140
1.60	1,000	2.90	2,420	4.40	4,620	7.00	9,640
1.70	1,100	3.00	2,550	4.60	4,960	7.20	10,160
1.80	1,200	3.10	2,690	4.80	5,300		
1.90	1,310	3.20	2,830	5.00	5,640		
2.00	1,420	3.30	2,970	5.20	5,980		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 19 discharge measurements made during 1904-1908, and the form of the 1903 curve at low water, and is well defined.

Monthly discharge of Bear River near Collinston, Utah, for 1907 and 1908.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,500	1,250	1,320	0.220	0.25	81,200	B.
February	3,460	1,260	2,340	.390	.41	130,000	B.
March	5,980	2,120	3,410	.568	.65	210,000	B.
April	8,790	5,850	7,270	1.21	1.35	433,000	B.
May	9,280	6,000	7,350	1.22	1.41	452,000	B.
June	10,200	7,130	8,600	1.43	1.60	512,000	B.
July	6,850	3,000	4,740	.790	.91	291,000	B.
August	3,250	900	1,870	.312	.36	115,000	B.
September	2,080	810	1,590	.265	.30	94,600	A.
October	2,300	1,750	1,940	.323	.37	119,000	A.
November	2,080	1,860	1,980	.330	.37	118,000	A.
December	3,530	900	1,960	.327	.38	121,000	B.
The year	10,200	810	3,700	.615	8.36	2,680,000	
1908.							
January	2,080	1,530	1,890	0.315	0.36	116,000	B.
February	2,420	1,310	1,810	.302	.33	104,000	A.
March	3,820	1,970	2,610	.435	.50	160,000	A.
April	3,670	2,300	2,800	.467	.52	167,000	A.
May	2,420	1,530	1,870	.312	.36	115,000	A.
June	5,470	2,420	3,980	.663	.74	237,000	A.
July	2,970	385	1,020	.170	.20	62,700	A.
August	725	500	646	.108	.12	39,700	A.
September	1,000	645	803	.134	.15	47,800	A.
October	1,860	1,100	1,580	.263	.30	97,200	A.
November	1,860	1,200	1,670	.278	.31	99,400	A.
December	1,860	500	1,360	.227	.26	83,600	B.
The year	5,470	385	1,840	.306	4.15	1,330,000	

NOTE.—Daily discharges for January 1 to August 15, 1907, were obtained from weekly gage readings by the aid of a hydrograph, following the rate of rise and fall of the river at the Preston station.

LOGAN RIVER NEAR LOGAN, UTAH.

Logan River rises on the west slope of the Bear River Range, flows southwest, then northwest, and unites with Bear River near Benson, Utah. The entire basin is rough and rugged, the elevations ranging from 4,500 to 9,000 feet, and the stream being confined largely to a steep and rough channel in a comparatively narrow canyon. The principal rock is a compact limestone with little or no soil covering except near the summit of the range, where a thin layer supports large groves of fir and aspen. The lower reaches of the stream are practically barren of timber except for a few scattered pines and a growth of underbrush. A large amount of timber has been cut and the area has been overgrazed by sheep and cattle.

Probably three-fourths of the precipitation in the basin is snow, the melting of which forms the chief source of supply for the spring and early summer flow; the late summer and winter flow is derived chiefly from springs, which are well distributed over the basin.

In its upper course the Logan receives numerous short and swift tributaries. Temple Fork and South Fork, which enter, respectively,

about 10 and 15 miles above the Logan, are perennial streams and furnish one-third to one-fourth of the total flow. Blacksmith Fork comes in below the gaging station. None of the run-off is stored at present. The entire flow of the river after being used to develop power at two electric plants near the mouth of the canyon, is diverted for irrigation.

A gaging station was established June 1, 1896, about 2 miles east of the city of Logan, near the mouth of the canyon. It was discontinued July 18, 1903, and reestablished April 13, 1904, at a point along the canyon road about 50 feet below the highway bridge, at the mouth of the canyon, 800 feet below the Hercules power house and about 1,000 feet above the old gaging station.

This point is above Blacksmith Fork and Cache River and is below all other tributaries. It is above all diversions except the Logan, Hyde Park, and Smithfield canal. Records have been kept on this canal at various times in order to determine the total flow of the river. (See p. 45.) The drainage area is 218 square miles.

The gage was moved downstream about 400 feet January 1, 1906. The datum has not been changed since that date.

Practically no ice forms at this station and measuring conditions are fairly good, but the channel shifts considerably. Velocities are so high that bowlders and gravel are moved along the river bed during floods. The results are therefore liable to some error.

Discharge measurements of Logan River near Logan, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 25	G. T. Burridge	75	190	4.15	1,070
July 20	do	64	153	3.60	752
August 13	La Rue and Burridge	48	113	2.82	410
November 11	A. D. Williams	45	81	2.25	203
1908.					
July 22	A. D. Williams	45	82	2.35	221

Daily gage height, in feet, of Logan River near Logan, Utah, for 1907 and 1908.

[Telluride Power Company, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.15	2.1	2.1	2.5	3.2	4.6	4.25	3.15	2.6	2.45	2.4	2.2
2	2.15	2.15	2.25	2.55	3.25	4.7	4.2	3.1	2.65	2.5	2.3	2.2
3	2.15	2.2	2.15	2.65	3.2	5.2	4.25	3.0	2.55	2.45	2.3	2.2
4	2.15	2.35	2.1	2.75	3.25	5.25	4.3	3.0	2.55	2.4	2.3	2.2
5	2.15	2.6	2.2	2.75	3.2	5.3	4.2	3.1	2.6	2.4	2.3	2.2
6	2.15	2.4	2.15	2.8	3.1	5.3	4.15	3.0	2.55	2.4	2.3	2.2
7	2.15	2.35	2.2	2.9	3.15	5.4	4.0	3.0	2.55	2.4	2.3	2.2
8	2.05	2.35	2.2	3.0	3.2	5.5	4.0	2.9	2.5	2.4	2.3	2.2
9	1.95	2.2	2.1	3.0	3.2	5.2	4.0	3.0	2.5	2.4	2.3	2.2
10	2.0	2.15	2.05	3.1	3.15	5.2	4.05	2.9	2.5	2.4	2.3	2.2

Daily gage height, in feet, of Logan River near Logan, Utah, for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
11	2.1	2.15	2.2	3.2	3.2	5.0	4.0	2.85	2.5	2.4	2.3	2.2
12	2.2	2.05	2.2	3.3	3.35	5.0	3.9	2.85	2.5	2.4	2.3	2.2
13	2.05	2.1	2.2	3.35	3.4	4.9	4.0	2.8	2.5	2.45	2.25	2.2
14	2.05	2.05	2.2	3.4	3.2	4.6	3.95	2.8	2.45	2.4	2.3	2.15
15	2.1	2.0	2.2	3.5	3.2	4.6	3.8	2.8	2.45	2.35	2.25	2.15
16	2.1	2.05	2.25	3.6	3.5	4.5	3.7	2.8	2.45	2.35	2.25	2.15
17	2.15	2.1	2.25	3.75	3.5	4.4	3.5	2.8	2.45	2.35	2.25	2.1
18	2.15	2.1	2.3	3.6	4.1	4.4	3.6	2.75	2.45	2.3	2.25	2.1
19	2.1	2.25	2.6	3.5	4.7	4.3	3.6	2.75	2.45	2.3	2.25	2.1
20	2.0	2.25	3.0	3.35	5.0	4.3	3.6	2.75	2.45	2.3	2.25	2.1
21	2.05	2.3	3.1	3.2	5.3	4.25	3.6	2.75	2.4	2.3	2.25	2.1
22	2.0	2.35	2.95	3.1	5.3	4.2	3.5	2.75	2.4	2.3	2.2	2.1
23	2.0	2.35	3.0	3.1	5.3	4.2	3.4	2.75	2.4	2.3	2.2	2.25
24	2.0	2.25	2.85	3.1	5.4	4.2	3.4	2.7	2.4	2.35	2.2	2.25
25	2.05	2.25	2.75	3.1	5.0	4.15	3.4	2.7	2.4	2.35	2.2	2.2
26	2.1	2.3	2.7	3.15	4.7	4.15	3.4	2.65	2.4	2.35	2.25	2.2
27	2.1	2.3	2.6	3.2	4.1	4.15	3.2	2.65	2.4	2.35	2.25	2.2
28	2.15	2.3	2.65	3.3	4.1	4.15	3.1	2.65	2.4	2.4	2.25	2.2
29	2.1	.....	2.6	3.35	4.3	4.15	3.1	2.65	2.4	2.4	2.2	2.15
30	2.1	.....	2.4	3.3	4.1	4.15	3.1	2.65	2.5	2.4	2.2	2.2
31	2.1	.....	2.6	.....	4.3	.....	3.2	2.65	.....	2.4	.....	2.15
1908.												
1	2.15	2.0	2.0	2.0	2.3	2.7	3.0	2.3	2.1	2.15	2.05	2.0
2	2.15	2.0	2.0	2.0	2.3	2.7	2.95	2.3	2.1	2.1	2.05	1.9
3	2.1	2.0	2.1	2.0	2.3	2.7	2.9	2.25	2.1	2.1	2.0	2.1
4	2.15	2.15	2.15	2.0	2.3	2.7	2.9	2.25	2.05	2.15	1.95	2.0
5	2.1	2.1	2.1	2.0	2.4	2.7	2.85	2.25	2.05	2.1	2.0	2.1
6	2.1	2.1	2.0	2.05	2.5	2.7	2.8	2.3	2.05	2.1	2.0	1.9
7	2.15	2.0	2.0	2.1	2.7	2.75	2.8	2.3	2.05	2.1	2.0	2.1
8	2.15	2.05	2.0	2.1	2.8	2.75	2.75	2.25	2.05	2.1	2.0	2.0
9	2.15	2.05	2.0	2.1	2.8	2.85	2.75	2.25	2.05	2.1	1.9	1.9
10	2.15	2.15	2.0	2.1	2.8	2.9	2.7	2.2	2.0	2.1	1.85	2.0
11	2.15	2.15	2.0	2.15	2.6	3.05	2.65	2.2	2.0	2.1	2.0	1.9
12	2.15	2.15	2.0	2.2	2.6	3.1	2.6	2.2	2.0	2.1	2.0	1.9
13	2.15	2.0	2.0	2.3	2.6	3.15	2.6	2.2	2.0	2.1	2.05	2.0
14	2.15	2.0	2.0	2.35	2.6	3.2	2.55	2.2	2.0	2.1	1.85	1.9
15	2.15	2.0	2.0	2.4	2.55	3.3	2.55	2.2	2.0	2.1	1.95	1.9
16	2.15	2.1	2.1	2.4	2.6	3.35	2.5	2.15	2.0	2.1	1.95	1.9
17	2.15	2.1	2.15	2.45	2.6	3.4	2.5	2.15	2.0	2.1	1.95	1.9
18	2.15	2.1	2.2	2.5	2.5	3.45	2.5	2.15	2.0	2.1	2.15	1.9
19	2.15	2.1	2.15	2.5	2.6	3.45	2.45	2.15	2.1	2.1	2.15	1.9
20	2.15	2.15	2.15	2.6	2.7	3.4	2.4	2.15	2.1	2.1	2.05	1.9
21	2.15	2.15	2.15	2.7	2.6	3.2	2.4	2.15	2.1	2.15	2.05	1.85
22	2.15	2.05	2.15	2.75	2.6	3.1	2.35	2.15	2.1	2.15	2.05	1.85
23	2.15	2.05	2.15	2.75	2.7	3.0	2.35	2.15	2.2	2.05	2.0	1.85
24	2.15	2.1	2.15	2.6	2.7	3.5	2.35	2.15	2.2	2.05	2.05	1.8
25	2.15	2.1	2.05	2.5	2.7	3.1	2.35	2.15	2.1	2.05	2.05	1.8
26	2.15	2.1	2.1	2.45	2.65	3.1	2.3	2.1	2.1	2.1	2.0	1.9
27	2.15	2.15	2.1	2.4	2.65	3.15	2.3	2.1	2.1	2.1	2.0	1.9
28	2.15	2.15	2.0	2.3	2.65	3.1	2.3	2.1	2.1	2.15	2.05	1.9
29	2.1	2.15	2.0	2.3	2.7	3.5	2.3	2.1	2.1	2.05	2.0	1.9
30	2.1	.....	2.0	2.3	2.7	3.0	2.3	2.1	2.1	2.05	2.0	1.9
31	2.1	.....	2.0	.....	2.75	.....	2.3	2.1	.....	2.05	.....	1.9

Rating tables for Logan River near Logan, Utah.

JANUARY 1 TO MAY 23, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	50	2.10	190	2.50	380	2.90	660
1.70	70	2.20	230	2.60	440	3.00	740
1.80	94	2.30	274	2.70	510	3.10	820
1.90	122	2.40	324	2.80	585	3.20	905
2.00	154						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1906, and is well defined between gage heights 1.8 feet and 2.8 feet.

Rating tables for Logan River near Logan, Utah—Continued.

MAY 24, 1906, TO APRIL 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	64	2.40	212	2.90	490	3.40	870
2.00	84	2.50	256	3.00	560	3.50	950
2.10	110	2.60	305	3.10	635	3.60	1,030
2.20	138	2.70	360	3.20	710	3.70	1,115
2.30	172	2.80	420	3.30	790	3.80	1,200

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1906, and is well defined between gage heights 2.5 feet and 3.4 feet.

APRIL 16 TO OCTOBER 31, 1907.

[Daily discharges obtained by indirect method for shifting channels.]

NOVEMBER 1, 1907, TO JUNE 20, 1908.

2.00	115	2.50	315	2.90	560	3.30	850
2.10	145	2.60	370	3.00	630	3.40	930
2.20	180	2.70	430	3.10	700	3.50	1,015
2.30	220	2.80	495	3.20	775	3.60	1,100
2.40	265						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1907 and the form of the other curves, and is fairly well defined.

JUNE 21, 1908, TO DECEMBER 31, 1908.

1.80	55	2.30	205	2.80	455	3.20	725
1.90	75	2.40	245	2.90	520	3.30	800
2.00	100	2.50	290	3.00	585	3.40	875
2.10	130	2.60	340	3.10	655	3.50	950
2.20	165	2.70	395				

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908-9, and is fairly well defined.

Daily discharge, in second-feet, of Logan River near Logan, Utah, for 1907.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	635	1,640	1,200	543	314	263
2	.....	672	1,730	1,160	520	333	280
3	.....	635	2,150	1,200	474	297	266
4	.....	672	2,200	1,240	474	297	243
5	.....	635	2,250	1,160	520	314	246
6	.....	525	2,250	1,120	474	297	246
7	.....	560	2,350	990	474	297	246
8	.....	598	2,450	1,030	432	280	246
9	.....	598	2,150	1,030	474	280	246
10	.....	560	2,150	1,070	432	280	246
11	.....	598	1,910	1,030	411	280	246
12	.....	710	1,910	950	411	280	246
13	.....	750	1,820	1,030	390	280	263
14	.....	560	1,550	990	390	263	246
15	.....	560	1,550	870	390	263	231
16	990	790	1,420	830	390	263	231
17	1,110	790	1,330	672	390	263	231
18	990	1,290	1,330	750	371	263	216
19	910	1,820	1,240	750	371	263	216
20	790	2,100	1,240	750	371	263	216
21	672	2,350	1,200	750	371	246	216
22	598	2,350	1,160	718	371	246	216
23	598	2,350	1,120	666	371	246	216
24	598	2,450	1,120	666	352	246	231
25	598	2,050	1,070	666	352	246	231
26	598	1,780	1,070	666	333	246	231
27	635	1,240	1,070	566	333	246	231
28	710	1,200	1,070	520	333	246	246
29	710	1,370	1,070	520	333	246	246
30	710	1,200	1,120	520	333	280	246
31	.....	1,370	.....	566	333	.....	246

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Logan River near Logan, Utah, for 1906.

[Drainage area, 218 square miles.]

Month.	Discharge in second-feet.						Run-off.		Accuracy.
	River.			Canal (mean).	Total (mean).	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
	Maximum.	Minimum.	Mean.						
January	183	70	105	16.4	121	0.555	0.64	7,440	A.
February	111	62	97.4	15.3	113	.518	.54	6,280	A.
March	154	77	103	8.41	111	.509	.59	6,820	A.
April	410	108	267	8.45	275	1.26	1.41	16,400	A.
May	1,200	352	754	13.7	768	3.52	4.06	47,200	B.
June	1,030	658	868	39.8	908	4.17	4.65	54,000	B.
July	635	234	389	87.3	476	2.18	2.51	29,300	A.
August	476	155	209	58.1	267	1.22	1.41	16,400	A.
September	184	132	157	24.9	182	.835	.93	10,800	B.
October	256	84	129	11.1	140	.642	.74	8,610	B.
November	172	64	110	13.2	123	.564	.63	7,320	C.
December	138	110	123	13.0	136	.624	.72	8,360	C.
The year	1,200	62	276	25.8	302	1.38	18.83	219,000	

NOTE.—These discharges supersede those published in Water-Supply Paper 212, p. 27. Five second-feet have been deducted from the discharge of the canal, November 14 to 20, and 27 to December 31, this amount having been spilled into the river below the station on the canal and above the station on the river. Discharge measurements and gage heights for 1906 are given in Water-Supply Paper 212, pp. 26–27.

Monthly discharge of Logan River near Logan, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	138	74	108	6,640	C.
February	192	84	152	8,440	C.
March	635	97	247	15,200	B.
April	1,110	256	656	39,000	B.
May	2,450	525	1,150	70,700	C.
June	2,450	1,070	1,590	94,600	C.
July	1,240	520	860	52,900	B.
August	543	333	404	24,800	B.
September	333	246	272	16,200	B.
October	280	216	240	14,800	B.
November	265	180	206	12,300	B.
December	200	145	172	10,600	B.
The year	2,450	74	505	366,000	
1908.					
January	162	145	159	9,780	B.
February	162	115	141	8,110	B.
March	180	115	135	8,300	B.
April	462	115	239	14,200	B.
May	495	220	374	23,000	B.
June	972	430	671	39,900	B.
July	585	205	331	20,400	A.
August	205	130	161	9,900	A.
September	165	100	120	7,140	B.
October	148	115	130	7,990	B.
November	148	65	103	6,130	B.
December	130	55	82.1	5,050	C.
The year	972	55	221	160,000	

NOTE.—These discharges do not include the flow of the Logan, Hyde Park, and Smithfield canal, which diverts water past the station. The records on the canal for 1904 to 1907 give an approximate idea of the amount of diversion for other years. (See p. 45.)

LOGAN, HYDE PARK, AND SMITHFIELD CANAL NEAR LOGAN, UTAH.

This canal diverts water for irrigation and domestic use in the three towns. Records are fragmentary. Gage heights are available for parts of 1904 and 1905, for the entire year 1906, and for part of 1907.

The channel is permanent, however, and a rating curve has been developed from measurements made in 1909. These discharges, so far as are available, have been added to those at the station on Logan River at the mouth of the canyon in order to determine the total flow of the river.

The gage in the canal is above a spillway which discharges into the river above the station. The amount spilled has usually been estimated by the observer and has been deducted from the total discharge obtained as indicated above.

Discharge measurements of Logan, Hyde Park, and Smithfield canal near Logan, Utah, in 1905 and 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
August 24	W. D. Beers	10.0	14.0	4.50	31
1909.					
May 5	E. S. Fuller	9.5	6.0	3.90	10.4
June 12	do	10.8	18.2	5.10	60
July 17	do	10.5	22.8	5.55	87

Daily gage height, in feet, of Logan, Hyde Park, and Smithfield canal near Logan, Utah, for 1906 and 1907.

[Telluride Power Company, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.[a]												
1	4.00	4.09	3.90	3.65	3.79	4.15	5.35	5.50	4.35	4.30	4.00	4.15
2	4.00	4.10	3.75	3.68	3.78	4.30	5.30	5.50	4.35	4.25	4.10	4.15
3	4.00	4.08	3.70	3.70	3.78	4.40	5.30	5.50	4.35	4.30	4.00	4.15
4	4.05	4.05	3.72	3.73	3.78	4.42	5.40	5.50	4.35	4.25	4.00	4.15
5	4.30	4.05	3.75	3.73	3.79	4.42	5.40	5.48	4.35	4.12	4.10	4.15
6	4.20	4.08	3.75	3.73	3.79	4.43	5.45	5.48	4.35	4.05	3.90	4.15
7	4.20	4.00	3.75	3.73	3.45	4.42	5.50	5.48	4.35	4.10	4.10	4.15
8	4.00	4.05	3.73	3.75	.....	4.43	5.60	5.40	4.35	4.20	4.10	4.15
9	4.10	4.08	3.72	3.75	.....	4.50	5.60	5.40	4.35	4.10	4.05	4.15
10	4.30	4.08	3.65	3.80	.....	4.52	5.65	5.40	4.40	4.10	4.00	4.15
11	4.30	4.08	3.60	3.75	3.90	4.55	5.65	5.40	4.40	4.05	4.05	4.15
12	4.30	4.08	3.50	3.75	3.90	4.52	5.65	5.35	4.40	4.10	4.00	4.15
13	4.30	4.08	4.15	3.75	3.98	4.60	5.60	5.35	4.40	4.10	4.10	4.15
14	4.30	4.08	3.80	3.90	4.00	4.60	5.65	3.50	4.40	4.20	4.10	4.15
15	3.50	4.12	3.81	3.90	3.95	4.67	5.75	5.30	4.40	3.50	4.00	4.15
16	4.05	4.10	3.75	3.85	3.95	4.75	5.75	5.30	4.40	3.50	4.10	4.15
17	4.05	4.07	3.85	3.85	3.90	4.70	5.65	5.30	4.40	3.60	4.00	4.15
18	4.27	4.15	3.90	3.87	3.89	4.65	5.65	5.30	4.40	3.60	3.90	4.15
19	4.27	4.15	3.90	3.85	3.90	4.60	5.65	5.30	4.40	4.00	4.10	4.15
20	4.14	4.07	3.90	3.85	3.93	4.58	5.60	5.35	4.40	3.00	4.00	4.15

[a] These gage heights were omitted from the 1906 report, as not enough measurements were available at that time for constructing a rating.

Daily gage height, in feet, of Logan, Hyde Park, and Smithfield canal near Logan, Utah, for 1906 and 1907—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
21	4.03	4.10	3.88	3.85	3.95	4.70	5.60	5.35	4.40	3.00	4.00	4.15
22	4.02	4.10	3.90	3.87	4.40	4.75	5.60	4.05	4.40	3.50	4.05	4.15
23	4.15	4.10	3.92	3.87	4.40	4.70	5.60	4.40	4.40	3.30	4.10	4.15
24	4.08	4.08	3.94	3.87	4.47	4.65	5.60	4.35	4.45	3.40	4.15	4.15
25	4.05	4.08	3.90	3.89	4.40	4.90	5.55	4.35	4.40	3.50	4.15	4.15
26	4.05	4.09	3.90	3.89	4.78	4.90	5.55	4.35	4.35	3.70	4.20	4.15
27	4.03	4.08	3.90	3.87	4.50	5.40	5.55	4.35	4.30	3.60	4.20	4.15
28	4.03	4.01	3.90	3.87	4.10	5.50	5.50	4.35	4.28	4.00	4.15	4.15
29	4.03	.....	3.50	3.85	4.10	5.30	5.50	4.35	4.28	4.00	4.15	4.15
30	4.02	.....	3.65	3.78	4.05	5.35	5.50	4.35	4.30	3.80	4.15	4.15
31	4.05	.....	3.55	.....	4.10	.....	5.50	4.35	.....	3.70	.....	4.15
1907.												
1	4.15	4.15	.....	3.6	4.0	4.6	.....	.....	.....	.....	.....	.....
2	4.15	4.2	.....	3.65	4.1	4.6	.....	.....	.....	.....	.....	.....
3	4.15	4.2	.....	3.6	4.2	4.45	.....	.....	.....	.....	.....	.....
4	4.15	4.2	.....	3.65	4.15	4.5	.....	.....	.....	.....	4.5	.....
5	4.15	4.3	.....	3.6	4.2	4.3	.....	.....	.....	.....	.....	.....
6	4.15	4.3	.....	3.65	4.2	4.3	.....	.....	.....	.....	.....	.....
7	4.15	4.3	.....	3.65	4.2	4.3	.....	.....	.....	.....	.....	.....
8	4.15	4.3	.....	3.8	4.2	4.4	.....	.....	.....	.....	.....	.....
9	4.15	4.1	.....	3.9	4.15	4.5	.....	.....	.....	.....	.....	4.3
10	4.15	4.1	.....	3.9	4.3	4.2	.....	.....	.....	.....	.....	.....
11	4.15	4.1	.....	.....	4.1	4.3	.....	.....	.....	.....	.....	.....
12	4.15	4.1	.....	3.6	4.3	3.9	.....	.....	.....	.....	.....	.....
13	4.15	4.05	.....	3.7	4.7	4.0	.....	.....	.....	.....	.....	.....
14	4.1	4.1	.....	3.6	4.5	3.9	.....	.....	.....	.....	.....	.....
15	4.15	4.0	.....	3.8	4.5	3.9	.....	.....	.....	.....	4.4	.....
16	4.15	4.0	.....	4.0	4.3	.....	.....	.....	.....	.....	.....	.....
17	4.15	3.95	.....	4.1	4.5	.....	.....	.....	.....	.....	.....	.....
18	4.15	4.0	.....	4.2	4.5	.....	.....	.....	.....	.....	.....	.....
19	4.15	4.15	.....	4.0	4.6	.....	.....	.....	.....	.....	.....	4.3
20	4.1	4.1	.....	4.15	4.7	.....	.....	.....	.....	.....	.....	.....
21	4.2	4.15	.....	4.2	4.7	.....	.....	.....	.....	.....	.....	.....
22	4.0	4.1	.....	4.1	4.8	.....	.....	.....	.....	.....	.....	.....
23	4.1	4.15	.....	4.0	4.6	.....	.....	.....	.....	4.5	.....	.....
24	4.1	.....	.....	4.2	4.6	.....	.....	.....	.....	.....	.....	.....
25	4.1	.....	.....	4.3	4.7	.....	.....	.....	.....	.....	.....	.....
26	4.1	.....	.....	4.2	4.5	.....	.....	.....	.....	.....	.....	4.3
27	4.15	.....	.....	3.7	4.3	.....	.....	.....	.....	.....	.....	.....
28	4.15	.....	.....	3.8	4.6	.....	.....	.....	.....	.....	.....	.....
29	4.2	.....	.....	3.9	4.5	.....	.....	.....	.....	.....	4.3	.....
30	4.15	.....	.....	4.0	4.3	.....	.....	.....	.....	.....	.....	.....
31	4.15	.....	.....	.....	4.6	.....	.....	.....	.....	.....	.....	.....

Rating table for Logan, Hyde Park, and Smithfield canal near Logan, Utah, for 1904 to 1909.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	0	3.80	8.2	4.60	35	5.40	78
3.10	.3	3.90	10.4	4.70	39	5.50	84
3.20	.9	4.00	13	4.80	44	5.60	90
3.30	1.6	4.10	16	4.90	49	5.70	96
3.40	2.5	4.20	19	5.00	54	5.80	102
3.50	3.6	4.30	23	5.10	60	5.90	109
3.60	4.8	4.40	27	5.20	66	6.00	116
3.70	6.4	4.50	31	5.30	72		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1905, 3 during 1909, and the point of zero discharge, and is well defined.

Monthly discharge of Logan, Hyde Park, and Smithfield canal near Logan, Utah, for 1904 to 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1904.[a]					
June 4–30	109	60	87.6	4,690	B.
July	109	96	105	6,460	B.
August	109	78	95.9	5,900	B.
September 1–10	84	78	79.2	1,570	B.
1905.					
September 17–23	30	29	29.3	407	B.
1906.					
January	23	3.6	16.4	1,010	B.
February	18	13	15.3	850	B.
March	18	3.6	8.41	517	C.
April	10.4	5.6	8.45	503	C.
May	43	3	13.7	842	B.
June	84	18	39.8	2,370	B.
July	99	72	87.3	5,370	B.
August	84	3.6	58.1	3,570	B.
September	29	22	24.9	1,480	B.
October	23	0	11.1	682	B.
November	19	10.4	15.1	898	B.
December	18	18	18.0	1,110	B.
The year	99	0	26.4	19,200	
1907.					
January	19	13	17.5	1,080	B.
February 1–23	23	11.7	17.3	789	B.
April	23	0	10.5	625	C.
May	44	13	27.5	1,690	B.
June 1–15	35	10.4	22.9	681	B.
October 24–31			31.0	492	C.
November			27.0	1,610	C.
December			23.0	1,410	C.

[a] Gage heights for 1904 are given in Water-Supply Paper 133, p. 248, for September 17 to 23, 1905; they ranged from 4.45 to 4.47. This is the only portion of 1905 for which records are available.

NOTE.—Water was spilled from the canal below the gage into the river above the station on the latter, as follows: November 14 to 20, and November 27 to December 31, 1906, 5 second-feet; January 1 to May 31, 1907, 2 to 7.5 second-feet; August 26 to December 31, 1907, 1 to 10 second-feet. These figures are very uncertain, as they were only estimated by the observer.

BLACKSMITH FORK AND POWER-PLANT RACE NEAR HYRUM, UTAH.

Blacksmith Fork rises on the western slope of the Bear River Range and flows southwest and then northwest into Logan River. The drainage basin of the tributary is in every way similar to that of the main stream. Only the flood and winter discharge, however, reaches the Logan, the entire spring and summer flow being used for irrigation on the tillable lands below the gaging station.

The station on Blacksmith Fork was established July 19, 1900, near the tollgate in the mouth of the canyon near Hyrum, Utah, and was discontinued December 31, 1902. It was reestablished May 16, 1904, about 1,000 feet farther downstream, 800 feet above the Hyrum city power plant and 500 feet below the intake of the power canal or race.

A station was established on the power-plant race on the same date, to determine the amount diverted past the station on the river. The combined records show the total supply in Blacksmith Fork above diversions for irrigation.

Ice does not form at either gage, and conditions at both stations are good, although the channel of the river shifts slightly at high stages, owing to the very swift current.

Discharge measurements of Blacksmith Fork near Hyrum, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 22	G. T. Burridge	56	134	5.90	1,110
June 8	do	54	111	5.40	719
June 25	do	43	78	4.65	346
July 20	do	43	60	4.40	229
August 13	La Rue and Burridge	43	59	4.30	185
1908.					
July 23	A. D. Williams	38	32	3.60	64

Daily gage height, in feet, of Blacksmith Fork near Hyrum, Utah, for 1907 and 1908.

[Uriah Benson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.4	3.6	3.6	4.1	5.6	5.6	4.6	4.3	4.2	4.1	4.0	3.8
2	3.4	3.6	3.6	4.3	5.6	5.5	4.6	4.3	4.2	4.1	4.0	3.8
3	3.4	3.6	3.7	4.5	5.6	5.6	4.6	4.3	4.2	4.1	4.0	3.8
4	3.4	3.6	3.6	4.5	5.6	5.6	4.6	4.3	4.2	4.1	4.0	3.8
5	3.4	3.6	3.6	4.5	5.6	5.6	4.5	4.3	4.2	4.1	4.0	3.8
6	3.4	3.9	3.6	4.6	5.6	5.6	4.5	4.3	4.2	4.1	4.0	3.8
7	3.4	4.1	3.6	4.4	5.5	5.5	4.5	4.3	4.2	4.1	4.0	3.8
8	3.4	4.1	3.7	5.1	5.4	5.5	4.5	4.3	4.2	4.1	4.0	3.8
9	3.4	4.1	3.7	4.9	5.4	5.4	4.6	4.3	4.2	4.0	4.0	3.8
10	3.4	3.7	3.6	5.1	5.4	5.4	4.6	4.3	4.2	4.0	4.0	3.8
11	3.4	3.7	3.7	5.4	5.8	5.5	4.6	4.3	4.2	4.0	4.0	3.8
12	3.4	3.7	3.7	5.6	5.9	5.5	4.6	4.3	4.2	4.0	4.0	3.8
13	3.4	3.6	3.7	5.7	5.8	5.6	4.6	4.3	4.2	4.0	4.0	3.8
14	3.4	3.6	3.6	5.8	5.8	5.6	4.6	4.3	4.2	4.0	4.0	3.8
15	3.4	3.6	3.6	6.2	5.4	5.7	4.5	4.3	4.2	4.0	4.0	3.8
16	3.4	3.5	3.6	6.8	5.4	5.7	4.5	4.3	4.2	4.0	4.0	3.8
17	3.4	3.5	3.7	5.9	5.7	5.7	4.5	4.3	4.2	4.0	4.0	3.8
18	3.4	3.5	3.9	5.9	5.8	5.5	4.5	4.3	4.2	4.0	4.0	3.8
19	3.4	3.5	4.4	5.8	5.8	5.4	4.5	4.3	4.2	4.0	4.0	3.8
20	3.4	3.6	4.4	5.2	6.3	5.4	4.5	4.3	4.2	4.0	4.0	3.8
21	3.4	3.6	4.4	5.3	6.4	5.3	4.5	4.3	4.2	4.0	4.0	3.8
22	3.4	3.7	4.4	5.4	6.5	5.3	4.5	4.3	4.2	4.0	4.0	3.8
23	3.4	3.8	4.4	5.4	5.9	5.3	4.5	4.3	4.2	4.0	4.0	3.8
24	3.4	3.7	3.9	5.4	5.8	4.9	4.5	4.3	4.2	4.0	3.8	3.8
25	3.4	3.7	3.8	5.4	5.8	4.9	4.5	4.3	4.2	4.0	3.8	3.8
26	3.4	3.8	3.8	5.6	5.8	4.8	4.6	4.3	4.2	4.0	3.8	3.8
27	3.4	3.7	3.7	5.6	5.8	4.8	4.6	4.3	4.2	4.0	3.8	3.8
28	3.4	3.6	3.7	5.7	5.9	4.7	4.5	4.3	4.2	4.0	3.8	3.8
29	3.4	.....	3.9	5.7	5.9	4.7	4.5	4.3	4.2	4.0	3.8	3.8
30	3.4	.....	3.8	5.6	5.8	4.7	4.5	4.2	4.2	4.0	3.8	3.8
31	3.6	.....	3.6	.....	5.8	.....	4.5	4.2	.....	4.0	.....	3.8
1908.												
1	3.7	3.6	3.7	3.7	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.5
2	3.7	3.7	3.7	3.7	3.9	3.8	3.7	3.6	3.6	3.6	3.4	3.5
3	3.7	3.7	3.7	3.7	3.9	3.8	3.7	3.6	3.6	3.6	3.4	3.5
4	3.7	3.7	3.7	3.6	3.9	3.8	3.7	3.6	3.6	3.6	3.4	3.5
5	3.7	3.7	3.7	3.6	3.8	3.8	3.7	3.6	3.6	3.6	3.4	3.5
6	3.7	3.7	3.7	3.6	3.8	3.8	3.7	3.6	3.6	3.6	3.4	3.5
7	3.7	3.7	3.7	3.6	3.8	3.8	3.7	3.6	3.6	3.6	3.4	3.5
8	3.8	3.7	3.7	3.6	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.5
9	3.8	3.7	3.7	3.7	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.5
10	3.8	3.7	3.7	3.7	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.5

Daily gage height, in feet, of Blacksmith Fork near Hyrum, Utah, for 1907 and 1908 Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	3.8	3.7	3.7	3.8	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.5
12	3.8	3.7	3.7	3.8	3.8	3.9	3.7	3.6	3.6	3.5	3.4	3.5
13	3.8	3.7	3.7	3.8	3.7	3.9	3.7	3.6	3.6	3.5	3.4	3.5
14	3.8	3.7	3.7	3.8	3.7	3.9	3.7	3.6	3.6	3.5	3.4	3.5
15	3.8	3.7	3.7	3.9	3.7	3.9	3.7	3.6	3.6	3.5	3.4	3.4
16	3.8	3.7	3.7	3.9	3.7	3.9	3.7	3.6	3.6	3.5	3.4	3.4
17	3.8	3.7	3.7	3.9	3.7	3.9	3.7	3.6	3.5	3.5	3.5	3.4
18	3.8	3.7	3.7	3.9	3.7	3.9	3.7	3.6	3.5	3.5	3.5	3.4
19	3.8	3.7	3.7	3.9	3.8	4.1	3.6	3.6	3.5	3.5	3.5	3.4
20	3.8	3.7	3.7	3.9	3.8	4.1	3.6	3.6	3.5	3.4	3.5	3.4
21	3.8	3.7	3.7	3.9	3.8	3.9	3.6	3.6	3.5	3.4	3.5	3.3
22	3.8	3.7	3.7	3.9	3.8	3.9	3.6	3.6	3.5	3.4	3.5	3.3
23	3.8	3.7	3.7	3.9	3.8	3.9	3.6	3.6	3.5	3.4	3.5	3.3
24	3.8	3.7	3.7	3.9	3.8	3.8	3.6	3.6	3.5	3.4	3.5	3.3
25	3.8	3.7	3.7	3.9	3.8	3.8	3.6	3.6	3.5	3.4	3.5	3.3
26	3.8	3.7	3.7	3.9	3.8	3.8	3.6	3.6	3.5	3.4	3.5	3.3
27	3.8	3.7	3.7	3.9	3.8	3.8	3.6	3.6	3.5	3.4	3.5	3.3
28	3.8	3.7	3.7	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.5	3.3
29	3.8	3.7	3.7	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.5	3.3
30	3.6	.....	3.7	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.5	3.3
31	3.6	.....	3.7	.....	3.8	.....	3.6	3.6	.....	3.4	.....	3.3

NOTE.—Ice does not form in sufficient quantities to interfere with the discharge.

Rating tables for Blacksmith Fork near Hyrum, Utah.

JANUARY 1, 1907, TO APRIL 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	42	4.20	224	5.00	622	5.80	1,164
3.50	57	4.30	260	5.10	684	5.90	1,244
3.60	75	4.40	302	5.20	746	6.00	1,326
3.70	94	4.50	350	5.30	810	6.10	1,410
3.80	115	4.60	398	5.40	876	6.20	1,496
3.90	138	4.70	448	5.50	944		
4.00	163	4.80	502	5.60	1,014		
4.10	192	4.90	560	5.70	1,088		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1905–1907 and the form of the later curve, and is well defined below gage height 4.1 feet. Below 4.0 feet it is the same as the 1906 table.

APRIL 16, 1907, TO JUNE 19, 1908.

3.60	44	4.50	268	5.40	724	6.30	1,410
3.70	58	4.60	310	5.50	792	6.40	1,490
3.80	75	4.70	354	5.60	864	6.50	1,570
3.90	95	4.80	400	5.70	940	6.60	1,650
4.00	116	4.90	448	5.80	1,018	6.70	1,730
4.10	140	5.00	498	5.90	1,096	6.80	1,810
4.20	166	5.10	550	6.00	1,174		
4.30	194	5.20	604	6.10	1,252		
4.40	228	5.30	662	6.20	1,330		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during the latter part of 1907 and the form of the previous curve for low water, and is fairly well defined.

JUNE 20, 1908, TO DECEMBER 31, 1908.

3.30	23	3.60	64	3.80	102	4.00	150
3.40	35	3.70	84	3.90	124	4.10	178
3.50	48						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908–9, and is well defined between gage heights 3.6 feet and 4.4 feet.

Discharge measurements of Blacksmith Fork power-plant race near Hyrum, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	G. T. Burridge	13.3	29	4.90	95
June 8	do	13.8	28	4.88	85
June 25	do	12.8	23	4.70	73
July 20	do	12.1	21	4.47	56
August 13	La Rue and Burridge	13.6	27	4.85	79
1908.					
July 23	A. D. Williams	14	28	4.90	92

Daily gage height, in feet, of Blacksmith Fork power-plant race near Hyrum, Utah, for 1907 and 1908.

[Uriah Benson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.7	4.9	4.9	4.9	4.8	4.7	4.6	4.9	4.7	4.6	4.6	4.9
2	4.7	4.9	4.9	4.9	4.8	4.8	4.6	4.9	4.7	4.6	4.6	4.9
3	4.7	4.9	4.9	4.9	4.8	4.8	4.6	4.9	4.7	4.6	4.6	4.9
4	4.7	4.9	4.9	4.9	4.8	4.9	4.6	4.9	4.7	4.6	4.6	4.9
5	4.7	4.9	4.9	4.9	4.8	4.9	4.6	4.9	4.7	4.6	4.6	4.9
6	4.7	5.1	4.9	4.9	4.8	4.9	4.6	4.8	4.7	4.6	4.6	4.9
7	4.7	5.1	4.9	4.9	4.7	4.9	4.6	4.8	4.7	4.6	4.6	4.9
8	4.7	5.1	4.9	4.9	4.7	4.9	4.6	4.8	4.7	4.6	4.6	4.9
9	4.7	4.9	4.9	4.9	4.7	4.8	4.6	4.8	4.7	4.7	4.6	4.9
10	4.7	4.9	4.9	4.9	4.7	4.9	4.6	4.8	4.7	4.7	4.6	4.9
11	4.7	4.9	4.9	4.9	4.8	4.8	4.6	4.8	4.7	4.7	4.6	4.9
12	4.7	4.9	4.9	4.9	4.9	4.7	4.6	4.8	4.7	4.7	4.6	4.9
13	4.7	4.9	4.9	4.9	4.8	4.7	4.6	4.8	4.7	4.7	4.6	4.9
14	4.7	4.9	4.9	4.9	4.7	4.7	4.5	4.8	4.7	4.7	4.6	4.9
15	4.7	4.9	4.9	4.9	4.7	4.7	4.5	4.8	4.7	4.7	4.6	4.9
16	4.7	4.9	4.9	4.9	4.7	4.7	4.7	4.8	4.7	4.7	4.6	4.9
17	4.7	4.9	4.9	4.8	4.8	4.8	4.7	4.8	4.7	4.7	4.6	4.9
18	4.7	4.9	4.9	4.8	4.8	4.8	4.7	4.8	4.7	4.7	4.6	4.9
19	4.7	4.9	4.9	4.8	4.9	4.8	4.7	4.8	4.7	4.7	4.6	4.9
20	4.7	4.9	4.9	4.8	4.9	4.8	4.7	4.8	4.7	4.7	4.6	4.9
21	4.7	4.9	4.9	4.6	4.9	4.8	4.6	4.8	4.6	4.7	4.6	4.9
22	4.7	4.9	4.9	4.6	4.9	4.8	4.6	4.8	4.6	4.7	4.6	4.9
23	4.7	4.9	4.9	4.7	4.9	4.8	4.5	4.8	4.6	4.7	4.6	4.9
24	4.7	4.9	4.9	4.7	4.9	4.7	4.5	4.8	4.6	4.7	4.9	4.9
25	4.7	4.9	4.9	4.7	4.9	4.7	4.5	4.8	4.6	4.7	4.9	4.9
26	4.7	4.9	4.9	4.9	4.9	4.7	4.5	4.8	4.6	4.7	4.9	4.9
27	4.7	4.9	4.9	4.9	4.9	4.7	4.5	4.8	4.6	4.7	4.9	4.9
28	4.7	4.9	4.9	4.9	4.9	4.6	4.5	4.8	4.6	4.7	4.9	4.9
29	4.7	.....	4.9	4.9	4.8	4.6	4.5	4.8	4.6	4.7	4.9	4.9
30	4.7	.....	4.9	4.9	4.9	4.6	4.9	4.7	4.6	4.7	4.9	4.9
31	4.9	.....	4.9	.....	4.9	.....	4.9	4.7	.....	4.7	.....	4.9
1908.												
1	4.8	4.6	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9
2	4.8	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9
3	4.8	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9
4	4.8	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9
5	4.8	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
6	4.8	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
7	4.8	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
8	4.8	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
9	4.8	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
10	4.8	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
11	4.8	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
12	4.8	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9
13	4.8	4.6	4.8	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9
14	4.8	4.6	4.8	4.8	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.9
15	4.8	4.6	4.8	4.9	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.8
16	4.8	4.6	4.8	4.9	4.8	4.9	4.9	4.9	4.9	4.9	4.9	4.8
17	4.7	4.6	4.8	4.9	4.8	4.9	4.9	4.9	4.8	4.9	4.9	4.7
18	4.7	4.6	4.8	4.9	4.8	4.9	4.9	4.9	4.8	4.9	4.9	4.6
19	4.7	4.6	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.5
20	4.7	4.6	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.5

Daily gage height, in feet, of Blacksmith Fork power-plant race near Hyrum, Utah, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.4
22	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
23	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
24	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
25	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
26	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
27	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
28	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
29	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
30	4.6	.....	4.8	4.8	4.9	4.9	4.9	4.9	4.8	4.9	4.9	4.9
31	4.6	.....	4.8	.....	4.9	.....	4.9	4.9	.....	4.9	.....	4.9

Rating table for Blacksmith Fork power-plant race near Hyrum, Utah, for 1905 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.40	51	4.60	66	4.80	80	5.00	96
4.50	58	4.70	73	4.90	88	5.10	104

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 17 discharge measurements made during 1904 to 1908, and is well defined.

Monthly discharge of Blacksmith Fork near Hyrum, Utah, for 1907 and 1908.

[Drainage area, 286 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	163	115	117	0.409	0.47	7,190	B.
February	296	145	184	.643	.67	10,200	B.
March	390	163	215	.752	.87	13,200	B.
April	1,900	280	865	3.02	3.37	51,500	B.
May	1,660	797	1,070	3.74	4.31	65,800	B.
June	1,020	420	787	2.75	3.07	46,800	B.
July	376	326	350	1.22	1.41	21,500	B.
August	282	239	273	.955	1.10	16,800	B.
September	239	232	237	.829	.92	14,100	B.
October	206	189	193	.675	.78	11,900	B.
November	182	163	177	.619	.69	10,500	B.
December	163	163	163	.570	.66	10,000	B.
The year	1,900	115	386	1.35	18.32	279,000	
1908.							
January	155	110	145	0.507	0.58	8,920	B.
February	131	110	128	.448	.48	7,360	B.
March	138	131	136	.476	.55	8,360	B.
April	183	124	160	.559	.62	9,520	B.
May	175	138	160	.559	.64	9,840	B.
June	266	163	183	.640	.71	10,900	B.
July	172	152	164	.573	.66	10,100	B.
August	152	152	152	.531	.61	9,350	B.
September	152	128	141	.493	.55	8,390	B.
October	144	123	131	.458	.53	8,060	B.
November	136	123	129	.451	.50	7,680	B.
December	136	74	120	.420	.48	7,380	B.
The year	266	74	146	.509	6.91	106,000	

NOTE.—These are the combined discharges of Blacksmith Fork and the power-plant race, which together give the total flow of the river.

WEBER RIVER BASIN.

DESCRIPTION.

Weber River rises on the northern slope of the Uinta Mountains and flows in a tortuous course northwestward into Great Salt Lake.

The upper portion of the basin is very rough. The highest peaks, reaching an elevation of about 13,000 feet, are masses of sandstone and quartzite, barren of vegetation and covered with snow for almost the entire year. Farther down the prevailing formation is limestone overlain with sandstone and conglomerate. A thin layer of soil covers the basin in patches and supports small groves of fir and aspen. The basin contains no extensive forests, meadows, or marshes. The greater part of the precipitation is in the form of snow, the melting of which is the chief source of the spring flood and early summer flow. A large part of the normal flow is derived from springs, which are well distributed over the area. Numerous tributaries, all short and confined to steep, narrow canyons, enter all along the course.

Between Oakley and Croyden the river traverses a very narrow valley comprising irrigated farms. The principal rock formation over this area is of conglomerate and sandstone, with but little loose and porous overlying soil except near the stream bed, where the deposit of bowlders and soil varies from 10 to 20 feet in depth. The chief tributaries in this stretch of the river are Beaver Creek, which enters from the south about 6 miles below Oakley and drains a rough country about 71 square miles in extent; Chalk Creek, from the east, which drains a rough, dry country about 428 miles in area and enters the Weber 15 miles above Croyden; and Lost Creek, which comes in from the east at a point about one-half mile above the Devils Slide gaging station and has a drainage area of 205 square miles.

Between Croyden and Plain City the stream flows in a well-defined channel through a comparatively narrow, steep canyon, with occasional stretches of valley containing irrigated farming lands. The rock is a porous and badly fissured sandstone and conglomerate, with but very little overlying soil. Near the mouth of the canyon the material is a very rough but compact limestone. East Creek, which enters near Morgan, discharges but little water into the river, as its flow is completely controlled by a storage reservoir about 5 miles above its mouth, the water being used for irrigation in Morgan Valley, through which the Weber flows. After leaving the Wasatch Range the Weber enters Great Salt Lake valley, through which it flows in a well-defined channel with no overflow.

Ogden River joins the Weber about 8 miles above Plain City. It drains a rough and rugged limestone area, 363 square miles in ex-

tent, in the western slopes of the Wasatch Range. The main stream and its numerous small tributaries are confined to steep, narrow canyons. The entire normal flow of the stream is diverted for irrigation near the foot of the canyon about 3 miles above the mouth of the river, after being used for the development of power by the Utah Light and Railway Company. The flood and winter flow, therefore, is all that reaches the Weber, except for a small amount of seepage from the irrigated district. The city of Ogden also derives its water supply from Ogden River.

At present no storage reservoirs are used on the Weber, but a number of sites are available.

The wettest year since records have been kept was 1907, when 1,270,000 acre-feet wasted into Great Salt Lake from the Weber basin, as shown by the records at the Plain City station. The year 1905 was by far the driest year, when only 298,000 acre-feet wasted into Great Salt Lake.

The gaging stations maintained in this basin are as follows:

Weber River near Oakley, Utah, 1904–1908.
Weber River near Croyden, Utah, 1905–1908.
Weber River near Uinta, Utah, 1889–1901, 1903.
Weber River near Plain City, Utah, 1903–1908.
Lost Creek near Croyden, Utah, 1905.
Chalk Creek at Coalville, Utah, 1904–5.
Ogden River at Ogden, Utah, 1895–1901.

WEBER RIVER NEAR OAKLEY, UTAH.

This station, which is located about 3 miles above Oakley, Utah, 200 feet south of the main canyon road, was established October 22, 1904, to determine the amount of water available for diversion through the low Kamas Pass into Provo River in connection with the Weber River project.

The station, which is about 6,600 feet above sea level, is below South Fork, above Beaver or Kamas Creek, and above all diversions to the Kamas prairie region.

The river is frozen two or three months during the winter, sometimes to a depth of nearly a foot, and occasionally forms jams when it goes out. Gage heights are also affected by slush and anchor ice. Fairly reliable estimates of discharge for the winter period can, however, be made by interpolating between days when open water is known to have existed, as the winter discharge varies little. The channel is permanent and records for the open-water periods are good.

Discharge measurements of Weber River near Oakley, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	G. T. Burridge	53	167	6.20	1,020
June 15	La Rue and Burridge	53	150	6.00	1,100
June 29	G. T. Burridge	58	206	7.00	1,850
July 23	do	51	139	5.80	690
August 17	La Rue and Burridge	47	85	4.70	190
1908.					
July 14	A. D. Williams	50	97	5.20	316

Daily gage height, in feet, of Weber River near Oakley, Utah, for 1907 and 1908.

[Elef Franson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	.....	4.4	5.35	6.6	8.0	5.25	4.55	4.3	4.2	4.25
2	4.15	4.15	4.15	4.45	5.35	6.7	8.0	5.2	4.55	4.3	4.2	4.2
3	.....	.....	.....	4.6	5.35	6.8	8.3	5.2	4.5	4.3	4.2	.....
4	.....	.....	.....	4.65	5.2	6.9	8.4	5.3	4.5	4.3	4.2	4.2
5	4.2	.....	.....	4.7	5.2	7.1	8.4	5.2	4.5	4.3	4.2	4.2
6	.....	4.15	4.1	4.6	5.2	7.1	8.5	5.25	4.5	4.3	4.2	4.2
7	.....	.....	.....	4.55	5.25	7.3	8.1	5.1	4.5	4.3	4.2	4.2
8	.....	.....	.....	4.55	5.25	7.0	7.5	5.05	4.45	4.3	4.2	4.2
9	4.2	4.15	4.1	4.65	5.3	6.7	7.5	4.9	4.45	4.3	4.2	4.2
10	.....	.....	.....	4.65	5.4	6.4	7.2	4.85	4.45	4.3	4.2	4.25
11	.....	.....	.....	4.7	5.6	6.4	7.0	4.8	4.4	4.3	4.2	4.25
12	4.4	.....	.....	4.8	5.8	6.8	6.8	4.75	4.4	4.3	4.2	4.25
13	.....	4.15	4.2	4.95	5.7	6.6	6.6	4.75	4.4	4.3	4.2	4.3
14	.....	.....	.....	5.7	5.6	6.4	6.6	4.75	4.4	4.3	4.15	4.3
15	.....	.....	.....	5.8	5.8	6.1	6.5	4.75	4.35	4.3	4.15	4.35
16	4.9	4.2	4.25	5.7	5.9	6.0	6.3	4.75	4.35	4.3	4.15	4.35
17	.....	.....	.....	5.55	6.05	6.0	6.2	4.75	4.3	4.3	4.15	4.5
18	.....	.....	.....	5.55	6.1	6.1	6.15	4.75	4.3	4.3	4.15	4.8
19	4.95	.....	.....	5.55	6.4	6.6	6.15	4.75	4.3	4.25	4.15	5.0
20	.....	4.15	4.5	5.15	6.7	6.8	6.1	4.75	4.3	4.25	4.2	5.0
21	.....	.....	.....	5.2	6.9	7.0	6.05	4.75	4.3	4.25	4.2	5.2
22	.....	.....	.....	5.2	7.0	7.4	5.9	.....	4.3	4.25	4.25	5.5
23	4.8	4.15	4.5	5.15	6.8	6.8	5.85	4.6	4.3	4.25	4.25	5.3
24	.....	.....	.....	5.2	6.6	6.6	5.75	4.6	4.3	4.25	4.25	5.3
25	.....	.....	.....	5.3	6.5	6.6	5.7	4.6	4.3	4.25	4.25	4.9
26	4.95	.....	.....	5.4	6.2	6.7	5.7	4.6	4.3	4.25	4.2	4.8
27	.....	4.15	4.45	5.45	6.1	6.9	5.65	4.6	4.3	4.25	4.2	4.5
28	.....	.....	.....	5.4	6.0	7.3	5.5	4.55	4.3	4.2	4.2	4.6
29	.....	.....	.....	5.4	6.0	7.4	5.45	4.55	4.3	4.2	4.2	4.7
30	4.15	.....	4.4	5.4	6.2	7.4	5.3	4.55	4.3	4.2	4.2	4.5
31	.....	.....	.....	.....	6.4	.....	5.25	4.55	.....	4.2	.....	4.3
1908.												
1	4.4	.....	4.0	4.1	4.75	5.35	6.15	4.75	4.25	4.4	4.45	4.5
2	4.5	4.3	4.0	4.1	4.8	5.3	6.1	4.9	4.25	4.45	4.45	4.6
3	4.7	4.3	4.0	4.15	.....	5.2	6.1	5.0	4.25	4.45	4.45	4.7
4	4.5	4.2	4.0	4.15	4.8	5.2	6.1	4.75	4.25	4.45	4.45	4.3
5	4.5	4.1	4.05	4.15	5.3	5.2	6.0	4.7	4.25	4.45	4.45	4.25
6	4.4	.....	4.1	4.2	5.45	5.2	6.05	5.05	4.25	4.5	4.45	4.25
7	4.9	4.1	4.2	4.2	5.4	5.2	5.9	4.85	4.2	4.5	4.45	4.3
8	6.4	4.1	4.2	4.25	5.45	5.3	5.8	4.7	4.2	4.5	4.3	4.35
9	6.1	4.1	4.1	4.25	5.5	5.4	5.6	4.7	4.2	4.5	4.3	4.5
10	6.15	4.1	4.1	4.3	5.5	5.7	5.4	4.7	4.2	4.55	4.3	4.3
11	6.2	4.1	4.05	4.35	5.45	6.3	5.3	4.7	4.2	4.55	4.3	4.2
12	6.25	4.15	4.0	4.4	5.4	6.8	5.15	4.75	4.3	4.55	4.3	4.25
13	5.7	4.2	4.0	4.45	5.3	6.8	5.15	4.75	4.25	4.5	4.3	4.2
14	5.2	.....	4.0	4.5	5.3	7.1	5.1	4.7	4.25	4.5	4.3	4.2
15	4.5	4.3	4.0	4.55	5.25	7.5	5.1	4.65	4.25	4.5	4.25	4.25

Daily gage height, in feet, of Weber River near Oakley, Utah, for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	4.4	4.2	4.0	4.6	5.2	6.8	5.05	4.65	4.25	4.5	4.25	4.3
17	4.4	4.1	4.05	4.7	5.1	6.6	5.0	4.55	4.25	4.5	4.2	4.7
18	4.4	4.1	4.05	4.8	5.15	6.4	4.9	4.5	4.25	4.5	4.2	5.0
19	4.4	4.15	4.05	4.85	5.25	6.1	4.8	4.5	4.25	4.5	4.2	5.4
20	4.3	4.0	.....	4.9	5.4	6.2	4.75	4.5	4.25	4.5	4.2	5.5
21	4.3	4.0	4.05	4.95	5.45	6.4	4.75	4.5	4.25	4.5	4.15	5.7
22	4.25	4.0	4.05	5.0	5.55	6.7	4.75	4.5	4.25	4.5	4.15	5.9
23	4.2	4.0	4.05	5.1	5.4	6.3	4.7	4.45	4.25	4.5	4.15	6.0
24	4.1	4.0	4.05	5.0	5.35	6.2	4.65	4.45	4.65	4.5	4.2	6.0
25	4.2	4.0	4.05	.....	5.4	6.5	4.65	4.45	4.55	4.5	4.2	5.8
26	4.2	4.0	4.05	4.95	5.4	6.9	4.65	4.45	4.5	4.5	4.2	5.7
27	4.2	4.0	4.05	4.9	5.45	7.2	4.6	4.45	.....	4.45	.....	5.6
28	4.3	4.0	4.05	4.8	5.4	7.4	4.6	4.3	4.45	4.45	4.2	5.6
29	.....	4.0	4.05	4.7	5.4	6.5	4.8	4.3	4.45	4.45	4.3	5.55
30	4.4	.....	4.05	4.7	5.45	6.1	4.7	4.3	4.4	4.45	4.35	5.3
31	4.4	.....	4.05	.....	5.3	.....	4.65	4.3	.....	4.45	.....	5.2

NOTE.—Ice conditions from about January 5 to 26, 1907; ice reaching a maximum thickness of 0.9 foot January 26. Ice along sides November 22 to 25 and beginning December 13, 1907. River frozen January 1 to 23, 1908, but not entirely over, the ice reaching a maximum thickness of 1.2 feet along the edges; there was some slush ice up to February 19. River frozen most of time from November 29 to December 31, 1908.

Rating table for Weber River near Oakley, Utah, for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	46	5.00	275	6.00	840	7.00	1,850
4.10	58	5.10	315	6.10	930	7.20	2,100
4.20	73	5.20	360	6.20	1,020	7.40	2,360
4.30	90	5.30	410	6.30	1,110	7.60	2,630
4.40	109	5.40	460	6.40	1,210	7.80	2,920
4.50	130	5.50	515	6.50	1,310	8.00	3,220
4.60	154	5.60	570	6.60	1,410	8.20	3,530
4.70	180	5.70	630	6.70	1,510	8.40	3,850
4.80	209	5.80	690	6.80	1,620	8.60	4,170
4.90	241	5.90	760	6.90	1,730		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 15 discharge measurements made during 1904–1908. For 1907 it is well defined between gage heights 4.1 feet and 7.0 feet, but for 1908 it is poorly defined, as the only measurement plots 10 per cent small.

Monthly discharge of Weber River near Oakley, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	.....	.....	66.0	4,060	C.
February	73	66	67.0	3,720	B.
March	130	58	91.3	5,610	B.
April	690	109	341	20,300	A.
May	1,850	360	847	52,100	A.
June	2,360	840	1,600	95,200	A.
July	4,010	385	1,660	102,000	A.
August	410	142	226	13,900	A.
September	142	90	106	6,310	A.
October	90	73	85.5	5,260	A.
November	73	66	71.6	4,260	B.
December	.....	.....	74.2	4,560	C.
The year	4,010	.....	436	317,000	

Monthly discharge of Weber River near Oakley, Utah, for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January			58.0	3,570	C.
February			52.2	3,000	C.
March	73	46	52.2	3,210	B.
April	315	58	160	9,520	B.
May	542	194	415	25,500	B.
June	2,490	360	1,120	66,600	A.
July	975	154	414	25,500	B.
August	295	90	160	9,840	B.
September	167	73	92.2	5,490	B.
October	142	109	128	7,870	B.
November	120	66	87.8	5,220	B.
December			69.4	4,270	C.
The year	2,490		234	170,000	

NOTE.—During the ice periods the discharge has been interpolated between days when the gage is unaffected by ice. The discharge during the winter seems to decrease gradually, reaching a minimum in February or March.

WEBER RIVER NEAR CROYDON, UTAH.

This station, which is located at Devils Slide, about 1½ miles west of the town of Croydon and 10 miles below the town of Echo, just below the canyon at the lower end of Henefer Valley, was established February 1, 1905, to determine the amount of water available for storage in the Henefer basin, about 2 miles above the station, in connection with the Weber River project.

Lost Creek enters one-fourth mile above the station and Chalk Creek about 15 miles above. The only diversions above the station are those in the Kamas prairie region and for the narrow valley below.

The flow is apparently little affected by ice. The occurrence of slush ice is noted, but no allowance is made for this. Otherwise the records are good, although the channel shifts slightly at high water. (See fig. 1, p. 21.)

Discharge measurements of Weber River near Croydon, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 25	G. T. Burridge	110	506	6.00	4,160
June 14	La Rue and Burridge	109	416	5.15	2,500
June 28	G. T. Burridge	108	369	4.75	2,060
July 23	do	101	231	3.35	890
Aug. 16	La Rue and Burridge	94	113	2.20	261
1908.					
July 15	A. D. Williams	96	118	2.40	340

Daily gage height, in feet, of Weber River near Croydon, Utah, for 1907 and 1908.

[George Simpson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.8	1.85	2.1	2.7	4.3	5.0	5.1	2.8	2.5	2.2	2.2	2.1
2	1.7	1.9	2.15	2.8	4.5	5.1	5.1	2.8	2.5	2.3	2.2	2.1
3	1.75	2.25	2.15	3.2	4.3	5.2	5.2	2.7	2.5	2.3	2.2	2.1
4	1.85	2.5	2.2	3.5	4.1	5.5	5.2	3.0	2.5	2.3	2.2	2.1
5	1.9	3.4	2.25	3.7	3.9	5.4	5.3	3.0	2.4	2.3	2.2	2.1
6	1.85	3.1	2.3	3.7	3.8	5.2	5.4	2.9	2.4	2.3	2.2	2.1
7	1.85	2.65	2.3	3.6	3.8	5.3	5.3	2.8	2.3	2.3	2.2	2.1
8	1.8	2.3	2.3	3.5	3.8	5.4	5.2	2.8	2.3	2.3	2.2	2.2
9	1.8	2.3	2.3	3.6	3.8	5.5	5.0	2.6	2.3	2.3	2.2	2.2
10	1.75	2.1	2.3	4.0	4.2	5.7	4.9	2.5	2.2	2.3	2.2	2.2
11	1.85	2.05	2.3	4.4	4.5	5.6	4.9	2.5	2.2	2.2	2.2	2.2
12	1.8	2.05	2.15	4.7	5.0	5.4	4.5	2.4	2.2	2.2	2.2	2.2
13	1.8	2.0	2.15	5.1	5.0	5.2	4.3	2.4	2.2	2.2	2.2	2.2
14	1.75	2.0	2.0	5.5	4.6	5.2	4.3	2.3	2.2	2.2	2.2	2.2
15	1.8	2.0	1.8	5.6	4.4	5.0	4.2	2.3	2.2	2.2	2.2	2.1
16	1.8	2.0	2.1	5.5	4.5	4.8	4.1	2.3	2.2	2.1	2.2	2.1
17	1.8	2.0	2.15	5.2	4.8	4.7	4.0	2.2	2.2	2.1	2.2	2.1
18	1.85	2.05	2.8	4.8	5.0	4.6	3.9	2.2	2.2	2.2	2.2	2.1
19	1.75	2.1	3.1	4.3	5.3	4.4	3.8	2.2	2.2	2.2	2.2	2.1
20	1.7	2.15	3.9	4.1	5.7	4.6	3.7	2.2	2.2	2.2	2.2	2.1
21	1.85	2.2	4.7	4.0	6.0	4.8	3.6	2.2	2.2	2.2	2.2	2.1
22	1.8	2.25	4.2	3.9	6.1	5.1	3.6	2.2	2.2	2.2	2.2	2.1
23	1.75	2.3	3.5	3.9	6.0	5.1	3.5	2.2	2.2	2.2	2.2	2.2
24	1.8	2.3	3.2	3.9	6.3	5.0	3.4	2.2	2.2	2.2	2.2	2.2
25	1.8	2.35	3.0	3.9	6.1	4.8	3.3	2.2	2.1	2.2	2.2	2.3
26	1.8	2.4	3.0	4.0	5.7	4.4	3.2	2.3	2.1	2.2	2.2	2.3
27	1.8	2.3	2.9	4.3	5.6	4.6	3.2	2.3	2.1	2.2	2.2	2.2
28	1.85	2.0	2.8	4.5	5.4	5.0	3.1	2.3	2.1	2.2	2.2	2.2
29	1.9	.....	2.8	4.4	5.3	4.9	3.1	2.4	2.1	2.2	2.1	2.2
30	1.9	.....	2.6	4.4	5.2	5.1	3.0	2.5	2.1	2.2	2.1	2.1
31	1.85	.....	2.6	.....	5.0	.....	2.9	2.5	.....	2.2	.....	2.1
1908.												
1	2.1	2.1	2.2	2.2	2.8	3.2	3.6	2.4	2.1	2.2	2.3	2.2
2	2.1	2.1	2.2	2.2	3.0	3.3	3.4	2.3	2.1	2.3	2.3	2.2
3	2.1	2.1	2.2	2.2	3.0	3.3	3.2	2.2	2.1	2.5	2.3	2.1
4	2.1	2.1	2.2	2.2	3.0	3.3	3.2	2.2	2.1	2.6	2.3	2.1
5	2.1	2.1	2.2	2.2	3.0	3.3	3.2	2.2	2.1	2.4	2.3	2.1
6	2.1	2.1	2.2	2.2	3.2	3.3	3.2	2.2	2.1	2.4	2.3	2.1
7	2.1	2.1	2.0	2.2	3.3	3.3	3.2	2.2	2.1	2.3	2.3	2.2
8	2.1	2.1	2.0	2.2	3.4	3.4	3.3	2.2	2.1	2.3	2.3	2.2
9	2.1	2.1	2.2	2.3	3.5	3.5	3.3	2.2	2.1	2.3	2.2	2.2
10	2.1	2.1	2.2	2.3	3.5	3.5	3.4	2.2	2.1	2.3	2.2	2.2
11	2.1	2.1	2.2	2.3	3.5	3.6	3.5	2.2	2.1	2.3	2.2	2.2
12	2.1	2.1	2.2	2.3	3.4	3.8	3.5	2.2	2.1	2.3	2.2	2.2
13	2.1	2.1	2.3	2.3	3.3	4.0	3.4	2.2	2.1	2.4	2.2	2.2
14	2.1	2.1	2.3	2.3	3.2	4.1	3.2	2.2	2.1	2.4	2.2	2.2
15	2.1	2.1	2.5	2.3	3.1	4.2	3.1	2.2	2.1	2.5	2.2	2.2
16	2.1	2.1	2.5	2.4	3.1	4.3	2.8	2.2	2.1	2.5	2.2	2.2
17	2.1	2.1	2.6	2.5	3.1	4.6	2.6	2.2	2.1	2.6	2.1	2.2
18	2.1	2.1	2.6	3.0	3.1	4.8	2.4	2.2	2.1	2.6	2.1	2.2
19	2.1	2.1	2.8	3.0	3.0	4.6	2.2	2.2	2.1	2.4	2.1	2.2
20	2.1	2.1	2.6	3.1	3.1	4.0	2.1	2.2	2.1	2.4	2.1	2.2
21	2.1	2.1	2.5	3.2	3.2	4.0	2.1	2.2	2.1	2.4	2.1	2.2
22	2.2	2.2	2.5	3.2	3.3	4.0	2.1	2.2	2.1	2.2	2.1	2.2
23	2.2	2.2	2.4	3.2	3.3	4.0	2.1	2.1	2.1	2.2	2.1	2.2
24	2.2	2.2	2.4	3.2	3.3	4.1	2.1	2.1	2.4	2.2	2.2	2.2
25	2.2	2.2	2.4	3.0	3.3	4.2	2.2	2.1	2.6	2.2	2.2	2.2
26	2.2	2.2	2.4	2.9	3.2	4.2	2.2	2.1	2.8	2.3	2.2	2.2
27	2.2	2.2	2.3	2.8	3.2	4.2	2.2	2.1	2.8	2.3	2.2	2.1
28	2.1	2.2	2.3	2.7	3.2	4.2	2.2	2.1	2.6	2.3	2.2	2.1
29	2.1	2.2	2.2	2.6	3.2	3.9	2.3	2.1	2.4	2.3	2.2	2.1
30	2.1	.....	2.2	2.5	3.2	3.7	2.3	2.1	2.2	2.3	2.2	2.1
31	2.1	.....	2.2	.....	3.2	.....	2.3	2.1	.....	2.3	.....	2.1

NOTE.—The flow during the winter period is probably not much affected by ice conditions.

Rating tables for Weber River near Croydon, Utah.

JANUARY 1 TO JUNE 4, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	110	2.60	584	3.70	1,438	4.80	2,542
1.60	138	2.70	646	3.80	1,528	4.90	2,652
1.70	166	2.80	712	3.90	1,620	5.00	2,764
1.80	202	2.90	782	4.00	1,716	5.20	3,000
1.90	240	3.00	856	4.10	1,816	5.40	3,270
2.00	280	3.10	930	4.20	1,916	5.60	3,570
2.10	322	3.20	1,008	4.30	2,018	5.80	3,870
2.20	368	3.30	1,090	4.40	2,120	6.00	4,170
2.30	418	3.40	1,174	4.50	2,224	6.20	4,470
2.40	472	3.50	1,260	4.60	2,328	6.40	4,770
2.50	526	3.60	1,348	4.70	2,434		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1906 and 1907, and is well defined. Below gage height 4.2 feet the rating table is the same as that for April to December, 1906.

JUNE 5, 1907, TO DECEMBER 31, 1908.

2.00	175	2.90	599	3.80	1,213	4.70	2,015
2.10	217	3.00	655	3.90	1,297	4.80	2,110
2.20	261	3.10	713	4.00	1,381	4.90	2,215
2.30	305	3.20	773	4.10	1,467	5.00	2,325
2.40	349	3.30	837	4.20	1,553	5.20	2,550
2.50	395	3.40	905	4.30	1,641	5.40	2,790
2.60	443	3.50	977	4.40	1,732	5.60	3,030
2.70	493	3.60	1,053	4.50	1,826	5.80	3,270
2.80	545	3.70	1,133	4.60	1,920		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1907 and 1908, and is well defined between gage heights 2.2 feet and 5.2 feet.

Monthly discharge of Weber River near Croydon, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	240	166	205	12,600	B.
February	1,170	221	408	22,700	B.
March	2,430	202	680	41,800	A.
April	3,570	646	1,930	115,000	A.
May	4,620	1,530	2,750	169,000	A.
June	3,420	1,730	2,460	146,000	A.
July	2,790	599	1,600	98,400	A.
August	655	261	382	23,500	A.
September	395	217	280	16,700	A.
October	305	217	271	16,700	A.
November	261	217	258	15,400	A.
December	305	217	240	14,800	B.
The year	4,620	166	955	693,000	
1908.					
January	261	217	226	13,900	B.
February	261	217	229	13,200	B.
March	545	175	317	19,500	B.
April	773	261	440	26,200	B.
May	977	545	778	47,800	A.
June	2,110	773	1,280	76,200	A.
July	1,050	217	561	34,500	B.
August	349	217	252	15,500	B.
September	545	217	264	15,700	B.
October	443	261	330	20,300	B.
November	305	217	262	15,600	B.
December	261	217	248	15,200	B.
The year	2,110	175	432	314,000	

WEBER RIVER NEAR PLAIN CITY, UTAH.

This station was established in 1903 under the direction of the state engineer of Utah, and was maintained by the State until May 14, 1905, when it was taken up by the United States Geological Survey in cooperation with the State. It is located at the highway bridge on the main road to Plain City and West Weber, 10 miles east of Ogden, and below all diversions and tributaries.

The records show the amount of water discharged into Great Salt Lake, information necessary for the adjudication of water rights on Ogden and Weber rivers.

Ice seldom affects the gage readings, although the river freezes occasionally during extremely cold weather. The current is very sluggish at low water, but at high stages the velocity reaches 3 feet per second and the bed, being composed of clay, sand, and gravel, shifts slightly. A good rating curve has usually been developed for the period between floods.

Discharge measurements of Weber River near Plain City, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 21	La Rue and Burridge	134	1,840	17.70	5,630
June 5	G. T. Burridge	134	1,730	16.60	4,820
June 11	do	133	1,650	16.20	4,480
June 30	do	131	1,100	11.85	2,790
July 22	do	122	487	6.90	959
August 10	La Rue and Burridge	112	143	4.00	188
1908.					
July 16	A. D. Williams	69	69	3.30	61

Daily gage height, in feet, of Weber River near Plain City, Utah, for 1907 and 1908.

[D. O. Wadman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.5	6.0	9.4	10.4	16.7	15.0	11.2	5.2	4.6	4.4	5.1	4.8
2	5.4	6.8	8.8	10.6	16.1	15.4	11.0	5.0	4.6	4.5	5.1	4.8
3	5.3	10.3	8.6	12.2	15.8	15.7	11.1	4.9	4.7	4.5	5.1	4.8
4	5.3	14.8	8.7	14.6	15.4	16.1	11.6	4.8	4.7	4.5	5.1	4.8
5	5.3	18.5	8.9	14.5	14.6	16.5	11.9	4.9	4.7	4.6	5.1	4.8
6	5.4	18.5	9.2	16.1	13.2	16.9	12.3	5.0	4.6	4.6	5.1	4.9
7	5.5	16.5	9.0	16.7	12.8	17.0	12.0	4.8	4.6	4.7	5.1	4.9
8	5.5	14.2	9.1	16.2	12.6	17.4	11.4	4.6	4.5	4.7	5.1	5.0
9	5.4	11.1	8.8	15.8	13.0	17.4	11.0	4.4	4.4	4.8	5.0	5.0
10	5.4	9.9	8.8	15.9	14.4	16.8	10.6	4.2	4.4	4.9	5.0	5.0
11	5.4	9.4	8.7	16.8	15.0	16.2	10.0	4.1	4.3	4.9	5.0	5.1
12	5.4	8.8	8.5	17.7	16.0	15.7	9.5	4.0	4.2	4.9	4.9	5.1
13	5.4	8.6	8.6	17.9	16.7	15.8	9.0	3.8	4.1	4.9	4.9	5.1
14	5.4	8.5	8.9	18.2	17.0	16.1	8.9	3.6	4.0	4.9	4.9	5.1
15	5.5	8.4	9.3	18.7	16.1	15.7	8.7	3.5	4.0	5.0	4.9	5.3
16	5.5	8.4	9.5	19.0	15.8	14.7	8.2	3.3	4.0	5.0	5.0	5.2
17	5.5	8.7	9.8	18.9	15.0	14.0	7.8	3.1	4.1	5.0	5.0	5.2
18	5.5	8.6	10.2	18.0	15.9	13.4	7.5	3.0	4.1	5.1	5.0	5.0
19	5.5	8.7	12.4	17.8	16.7	13.0	7.2	3.0	4.1	5.1	5.0	5.1
20	5.5	9.9	15.7	16.5	17.3	12.8	7.0	3.0	4.1	5.1	5.0	5.0

Daily gage height, in feet, of Weber River near Plain City, Utah, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	5.6	10.8	17.5	15.6	17.6	13.4	6.8	3.0	4.1	5.1	5.0	5.1
22	5.8	11.1	18.7	15.2	17.8	13.5	6.6	3.1	4.1	5.1	5.0	5.1
23	5.9	13.5	17.3	14.9	17.9	13.8	6.4	3.2	4.1	5.1	4.9	5.1
24	6.2	12.2	15.6	14.4	17.9	13.3	6.1	3.3	4.2	5.1	4.9	5.2
25	6.3	11.8	14.8	14.2	17.7	12.2	6.0	3.5	4.2	5.1	4.9	5.4
26	6.3	10.7	13.7	14.4	16.0	11.7	6.0	3.4	4.3	5.1	4.9	5.7
27	6.1	10.1	12.6	15.3	15.5	11.3	5.9	3.6	4.3	5.1	4.9	6.1
28	5.9	9.8	12.0	16.4	15.1	11.2	5.8	3.9	4.4	5.1	4.9	5.8
29	5.7	.....	11.4	16.9	14.9	11.3	5.7	4.5	4.4	5.1	4.9	5.5
30	5.5	.....	11.0	17.3	14.7	11.5	5.5	4.7	4.4	5.1	4.8	5.1
31	5.8	.....	10.7	.....	14.8	.....	5.3	4.5	.....	5.1	.....	5.0
1908.												
1	5.0	5.0	5.8	5.2	6.0	10.3	7.1	2.7	2.6	4.9	5.7	5.1
2	5.0	4.9	5.3	5.4	6.2	10.7	6.6	4.1	2.6	5.0	5.7	5.1
3	4.9	4.9	5.3	5.4	6.5	10.3	6.2	4.6	2.5	5.7	5.6	5.0
4	4.9	4.8	5.3	5.6	6.8	10.6	6.0	4.3	2.5	7.0	5.6	5.0
5	4.9	4.8	5.3	5.6	6.9	12.4	5.7	4.2	2.5	6.7	5.6	5.0
6	5.8	4.9	5.3	5.7	7.0	11.7	5.4	3.9	2.5	6.0	5.6	5.0
7	6.9	4.9	5.4	5.8	7.0	11.5	5.0	3.8	2.5	5.9	5.6	5.0
8	6.3	4.9	5.4	5.8	6.9	11.4	4.8	3.7	2.8	5.9	5.6	5.0
9	5.5	5.0	5.5	6.1	7.3	11.4	4.5	3.5	2.9	5.8	5.5	5.1
10	5.2	5.0	5.7	6.4	7.1	11.5	4.1	3.5	2.9	5.8	5.5	5.1
11	5.0	5.0	5.8	6.4	7.0	11.5	3.7	3.3	2.9	5.7	5.4	5.1
12	5.0	4.9	5.8	6.5	7.2	11.5	3.6	3.2	3.4	5.7	5.3	5.1
13	4.9	4.9	6.2	6.8	7.4	11.6	3.6	3.2	3.6	5.6	5.3	5.1
14	4.9	4.9	6.4	7.2	7.2	11.6	3.5	3.1	3.8	5.6	5.2	5.1
15	5.0	4.9	6.6	7.6	6.9	13.4	3.5	3.1	3.9	5.8	5.2	5.1
16	5.1	4.9	7.1	7.7	6.8	14.0	3.3	3.1	3.9	6.1	5.2	5.2
17	5.1	4.8	7.5	7.8	6.7	13.7	3.1	3.1	4.0	6.4	5.2	5.2
18	5.1	4.8	8.1	8.0	6.6	13.9	2.9	3.0	4.0	6.9	5.3	5.3
19	5.0	4.9	7.8	8.2	6.5	13.4	2.8	3.0	4.0	7.2	5.3	5.5
20	5.1	4.9	7.1	8.4	6.8	11.8	2.7	3.1	4.0	7.1	5.3	5.6
21	5.1	4.8	6.9	8.7	9.0	11.9	2.7	3.1	4.0	7.1	5.2	5.7
22	5.1	4.8	6.8	8.8	8.6	12.0	2.8	3.0	4.0	6.8	5.2	5.7
23	5.1	4.8	6.6	8.5	8.4	11.6	2.8	3.0	4.0	6.6	5.1	5.7
24	5.0	4.8	6.5	8.1	8.1	10.9	2.8	2.9	4.7	6.5	5.0	5.7
25	5.0	4.7	6.3	7.6	8.1	10.6	2.8	2.9	4.9	6.3	5.0	5.7
26	4.9	4.7	6.2	7.3	8.9	10.2	2.7	2.9	5.8	6.2	5.0	5.7
27	4.9	4.7	6.0	7.0	10.1	9.6	2.7	2.8	5.5	6.2	5.1	5.7
28	5.2	4.8	5.8	6.7	9.8	8.9	2.7	2.8	5.3	6.1	5.1	5.7
29	5.2	5.5	5.7	6.3	9.5	8.2	2.7	2.7	5.0	6.0	5.1	5.8
30	5.1	.....	5.6	5.8	9.2	7.7	2.7	2.7	4.9	6.0	5.1	5.8
31	5.0	.....	5.6	.....	9.3	.....	2.7	2.6	.....	5.8	.....	5.8

NOTE.—Ice conditions January 6 to 10 and December 16 to 31, 1908. There was probably little effect from ice in 1907.

Rating tables for Weber River near Plain City, Utah.

JANUARY 1, 1906, TO FEBRUARY 3, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.30	335	6.50	625	7.70	1,010	8.90	1,460
5.40	355	6.60	655	7.80	1,045	9.00	1,500
5.50	375	6.70	685	7.90	1,080	9.20	1,570
5.60	395	6.80	715	8.00	1,115	9.40	1,650
5.70	415	6.90	745	8.10	1,150	9.60	1,730
5.80	440	7.00	775	8.20	1,185	9.80	1,810
5.90	465	7.10	805	8.30	1,225	10.00	1,895
6.00	490	7.20	835	8.40	1,265	10.20	1,975
6.10	515	7.30	870	8.50	1,300	10.40	2,060
6.20	540	7.40	905	8.60	1,340		
6.30	565	7.50	940	8.70	1,380		
6.40	595	7.60	975	8.80	1,420		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1906, and is well defined.

Rating tables for Weber River near Plain City, Utah—Continued.

FEBRUARY 4, 1907, TO JUNE 14, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	58	4.40	251	5.80	576	8.40	1,384
3.10	68	4.50	269	5.90	602	8.60	1,456
3.20	78	4.60	289	6.00	628	8.80	1,528
3.30	90	4.70	311	6.20	680	9.00	1,600
3.40	102	4.80	333	6.40	734	10.00	1,980
3.50	116	4.90	355	6.60	790	11.00	2,380
3.60	130	5.00	379	6.80	850	12.00	2,790
3.70	145	5.10	403	7.00	910	13.00	3,210
3.80	160	5.20	427	7.20	974	14.00	3,650
3.90	175	5.30	451	7.40	1,038	15.00	4,090
4.00	190	5.40	475	7.60	1,104	16.00	4,530
4.10	205	5.50	500	7.80	1,172	17.00	4,970
4.20	220	5.60	525	8.00	1,240	18.00	5,420
4.30	235	5.70	550	8.20	1,312	19.00	5,880

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 10 discharge measurements made during 1906–7, and is well defined between gage heights 4.0 feet and 17.0 feet.

JUNE 15 TO DECEMBER 31, 1908.

2.50	7	3.80	118	5.10	330	6.80	796
2.60	11	3.90	130	5.20	352	7.00	860
2.70	16	4.00	143	5.30	374	7.20	926
2.80	21	4.10	157	5.40	398	7.40	994
2.90	27	4.20	172	5.50	422	7.60	1,064
3.00	34	4.30	187	5.60	446	7.80	1,136
3.10	42	4.40	203	5.70	472	8.00	1,210
3.20	51	4.50	220	5.80	498	8.20	1,286
3.30	61	4.60	237	5.90	526	8.40	1,362
3.40	72	4.70	255	6.00	554	8.60	1,438
3.50	83	4.80	273	6.20	612	8.80	1,514
3.60	94	4.90	291	6.40	672	9.00	1,590
3.70	106	5.00	310	6.60	732	10.00	1,980

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1908 and the form of previous curves, and is fairly well defined. Above gage height 10.0 feet it is the same as the previous table.

Monthly discharge of Weber River near Plain City, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	565	335	400	24,600	B.
February	5,650	490	2,380	132,000	A.
March	5,740	1,420	2,500	154,000	A.
April	5,880	2,140	4,500	268,000	A.
May	5,370	3,040	4,390	270,000	A.
June	5,150	2,460	3,870	230,000	A.
July	2,920	451	1,490	91,600	A.
August	427	58	197	12,100	B.
September	311	190	240	14,300	A.
October	403	251	360	22,100	A.
November	403	333	375	22,300	A.
December	654	333	412	25,300	A.
The year	5,880	58	1,760	1,270,000	

Monthly discharge of Weber River near Plain City, Utah, for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	.....	355	381	23,400	C.
February	500	311	352	20,200	B.
March	1,280	451	679	41,800	A.
April	1,530	427	901	53,600	A.
May	2,020	628	1,130	69,500	A.
June	3,650	1,100	2,520	150,000	A.
July	892	16	176	10,800	B.
August	237	11	64.7	3,980	B.
September	498	7	138	8,210	B.
October	926	291	604	37,100	A.
November	472	310	381	22,700	A.
December	498	310	389	23,900	C.
The year	3,650	7	643	465,000	

NOTE.—Discharge estimated January 6 to 10, 1908, on account of ice. Values for portions of the winter months may be somewhat too large on account of ice conditions.

PROVO RIVER BASIN.

DESCRIPTION.

Provo River rises in the Uinta Mountains and flows westward in a steep, narrow canyon until it reaches Heber or Provo Valley, through which it winds in a well-defined channel. Leaving the valley it flows southwestward, cutting through the Wasatch Range in another steep, narrow, and extremely rough canyon, and finally discharging its surplus waters into Utah Lake.

In the mountain regions the principal rock is a compact limestone. Except in Heber Valley little soil is found in any part of the basin. Small groves of fir and aspen are, however, scattered over almost the entire area, and there is a light growth of underbrush. No extensive forests, meadows, or marshes exist. In the canyons the stream receives numerous short and swift tributaries which derive their principal supply from springs, but a part also from the melting of the snow that covers portions of the mountains during the entire year. The highest peaks reach elevations of about 13,000 feet above sea level.

Heber Valley, comprising an area of about 20 square miles, is an irrigated farming district. The surface is covered with loose bowlders, gravel, and very porous soil. Most of the water is taken from the main stream, but a part is diverted from small creeks that enter the valley from the south. The most important of these is Daniels Creek, into which some water is diverted from Strawberry River, a tributary of Green River, by three small canals in low passes at the head of the creek.

At the head of the river are a few lakes, but they are so small that they probably have little effect in regulating the flow. No storage is used on the stream at present, but a few favorable sites will doubtless be developed in the future, as the entire flow, after being used by

a power plant at the mouth of the canyon, is now utilized in the vicinity of Utah Lake, and the supply is altogether insufficient.

The wettest year since records have been kept in this basin was 1907, when the discharge at the station of the Telluride Power Company's dam was 477,000 acre-feet. The driest year was 1905, when at the same station the discharge was 192,000 acre-feet.

The following stations have been maintained in this basin:

Provo River above Telluride Power Company's dam near Provo, Utah, 1905–1908.

Provo River at mouth of canyon, near Provo, Utah, 1889–1906.

Provo River at Denver and Rio Grande Railroad bridge, near Provo, Utah, 1905.

Provo River at San Pedro, Los Angeles and Salt Lake Railroad bridge, near Provo, Utah, 1903–4.

PROVO RIVER ABOVE TELLURIDE POWER COMPANY'S DAM, NEAR PROVO, UTAH.

This station, which was established February 1, 1905, to determine the total flow of the river into this valley, takes the place of the station at the mouth of the canyon, which has been maintained since 1889. It is located about one-half mile below Forks station, on the Provo Canyon branch of the Denver and Rio Grande Railroad, about 4 miles above the mouth of the canyon.

The station is below South Fork and all other tributaries and above all diversions into Utah Lake Valley. Some water is diverted for irrigation in Heber Valley above the station.

Little ice forms at this station. The gage heights have been somewhat affected by backwater from the diversion down below. This dam was raised about July 12, 1908, and the station had to be moved upstream a quarter of a mile, as near the forks as possible, but it is still too near the dam and results since that time have not been satisfactory.

Discharge measurements of Provo River above Telluride Power Company's dam near Provo, Utah, in 1906–1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 14	W. G. Swendsen	69	113	3.80	222
May 10	H. S. Kleinschmidt	76	222	5.30	886
June 3	Thomas Grieve, jr	80	244	5.40	993
June 13	do	96	396	7.00	1,760
July 7	do	71	156	4.20	402
1907.					
June 18	G. T. Burridge	84	282	5.90	1,390
July 6	do	102	390	7.45	1,880
July 26	La Rue and Burridge	76	188	4.93	642
August 20	do	70	138	4.15	349
1908.					
July 22	E. C. La Rue	76	197	[a] 5.02	245
September 5 [b]	do	72	110	2.13	229
October 30 [b]	do	74	170	3.05	390

[a] Affected by backwater. [b] At new station, established July 24, 1909.

Daily gage height, in feet, of Provo River above Telluride Power Company's dam near Provo, Utah, for 1907 and 1908.

[Telluride Power Company, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.05	3.9	4.3	4.3	5.4	5.8	6.85	4.4	4.25	4.2	4.2	4.2
2	3.9	4.0	4.25	4.5	5.4	6.1	7.15	4.4	4.25	4.25	4.2	4.2
3	3.9	4.3	4.3	4.7	5.2	6.9	7.25	4.3	4.25	4.25	4.2	4.2
4	4.0	4.9	4.3	4.8	5.05	7.0	7.2	4.4	4.25	4.2	4.2	4.2
5	4.05	5.1	4.35	5.0	5.0	7.3	7.5	4.35	4.5	4.2	4.2	4.2
6	4.1	4.9	4.2	5.05	4.95	7.65	7.45	4.35	4.5	4.2	4.2	4.2
7	4.0	4.5	4.2	4.9	4.9	7.8	7.2	4.25	4.35	4.25	4.2	4.2
8	3.9	4.4	4.15	4.75	4.85	7.9	6.8	4.25	4.3	4.2	4.2	4.2
9	3.9	4.5	4.35	4.7	4.8	7.6	6.55	4.25	4.35	4.2	4.2	4.2
10	3.85	4.45	4.2	5.0	4.8	7.1	6.35	4.2	4.3	4.2	4.2	4.2
11	3.9	4.5	4.3	5.4	5.1	6.1	6.2	4.2	4.3	4.2	4.2	4.2
12	3.95	4.4	4.3	5.5	5.35	6.85	5.95	4.2	4.3	4.2	4.2	4.2
13	3.9	4.45	4.2	6.1	5.6	7.4	5.8	4.15	4.3	4.25	4.2	4.2
14	3.9	4.5	4.2	6.3	5.3	6.8	5.9	4.15	4.25	4.2	4.2	4.2
15	3.9	4.45	4.15	6.6	5.0	6.5	5.7	4.15	4.25	4.2	4.2	4.2
16	3.95	4.45	4.05	6.6	5.0	6.1	5.55	4.15	4.2	4.2	4.2	4.2
17	4.0	4.1	4.45	6.3	5.35	5.95	5.3	4.15	4.2	4.2	4.2	4.2
18	4.0	4.05	4.6	6.0	5.65	5.9	5.1	4.15	4.2	4.2	4.2	4.15
19	3.95	4.1	4.75	5.75	6.15	6.2	5.1	4.15	4.15	4.2	4.2	4.15
20	3.8	4.1	4.85	5.4	6.8	6.6	5.0	4.15	4.15	4.2	4.2	4.15
21	3.7	4.1	5.05	5.1	7.45	6.8	4.95	4.15	4.2	4.2	4.2	4.2
22	3.7	4.3	4.8	5.1	7.7	7.1	4.85	4.15	4.2	4.2	4.2	4.2
23	3.65	4.5	4.7	5.1	7.7	7.2	4.8	4.15	4.2	4.2	4.2	4.2
24	3.7	4.3	4.5	5.1	7.9	6.4	4.75	4.15	4.2	4.2	4.2	4.2
25	3.95	4.25	4.5	5.1	7.6	6.1	4.7	4.2	4.2	4.2	4.2	4.2
26	4.0	4.3	4.5	5.15	6.8	6.1	4.7	4.2	4.2	4.2	4.2	4.2
27	4.05	4.3	4.55	5.2	6.4	6.2	4.65	4.2	4.2	4.2	4.2	4.4
28	4.1	4.25	4.4	5.5	6.1	6.6	4.6	4.2	4.2	4.2	4.2	4.3
29	3.95	.....	4.4	5.5	5.9	6.95	4.5	4.2	4.2	4.2	4.2	4.25
30	3.95	.....	4.35	5.4	5.8	7.0	4.45	4.3	4.2	4.2	4.2	4.0
31	3.9	.....	4.2	.....	5.85	.....	4.45	4.25	.....	4.2	.....	4.2
1908.												
1	4.2	3.75	4.25	4.1	4.5	5.75	5.7	2.65	2.1	2.7	3.0	2.8
2	4.2	3.9	4.2	4.1	4.8	5.5	5.65	2.4	2.1	2.7	3.0	2.8
3	4.15	4.1	4.2	4.1	4.9	5.65	5.6	2.3	2.1	2.85	3.0	3.0
4	4.2	4.15	4.2	4.1	5.1	5.5	5.55	2.35	2.15	2.9	3.0	2.9
5	4.0	4.1	4.35	4.05	5.0	5.7	5.5	2.1	2.1	3.0	3.0	2.9
6	3.9	4.05	4.25	4.05	5.3	5.65	5.55	2.55	2.1	3.0	3.0	2.9
7	3.8	4.1	4.15	4.1	5.1	5.5	5.5	2.8	2.1	2.85	3.0	2.8
8	3.8	4.1	4.1	4.1	5.15	5.6	5.35	2.6	2.1	2.9	3.0	2.85
9	4.0	4.1	4.1	4.1	5.3	5.55	5.25	2.3	2.2	2.9	2.9	2.9
10	4.2	4.1	4.1	4.1	5.5	5.55	5.2	2.3	2.15	2.95	3.0	2.9
11	4.0	4.05	4.15	4.1	5.35	5.75	5.0	2.55	2.2	2.95	2.95	2.9
12	4.1	4.1	4.15	4.15	5.25	6.2	.....	2.8	2.2	3.0	2.9	2.8
13	4.0	4.1	4.15	4.2	5.5	6.25	.....	2.7	2.2	3.0	2.9	2.9
14	4.1	4.0	4.2	4.3	5.35	6.4	.....	2.5	2.2	3.0	2.9	2.9
15	4.15	4.0	4.3	4.4	5.25	6.65	.....	2.4	2.2	3.0	2.9	2.9
16	4.1	4.05	4.3	4.5	5.25	7.0	.....	2.25	2.2	3.65	2.9	2.9
17	4.1	4.1	4.4	4.8	5.35	6.8	.....	2.2	2.15	3.4	2.9	2.9
18	4.1	4.05	4.4	4.7	5.35	6.4	.....	2.15	2.15	3.1	2.9	2.8
19	4.1	4.05	4.35	4.75	5.3	6.1	.....	2.1	2.15	3.1	2.9	3.6
20	4.1	4.15	4.2	4.9	5.7	5.9	.....	2.2	2.15	3.2	2.9	3.0
21	4.1	4.05	4.15	5.0	5.55	6.1	.....	2.2	2.15	3.15	2.9	3.6
22	4.1	4.05	4.1	5.15	5.4	6.25	.....	2.2	2.15	3.15	3.0	3.6
23	4.1	4.1	4.1	5.3	5.45	6.35	.....	2.15	2.15	3.0	2.9	2.7
24	4.15	4.1	4.1	5.2	5.5	6.0	.....	2.15	2.3	3.0	3.0	2.8
25	4.15	4.05	4.1	5.1	5.4	6.0	2.4	2.1	2.9	3.1	2.95	2.8
26	4.1	4.05	4.1	4.9	5.6	6.1	2.4	2.1	2.6	3.05	2.95	2.8
27	4.05	4.05	4.15	4.9	5.7	6.1	2.2	2.1	2.7	3.0	2.95	2.8
28	4.1	4.1	4.15	4.8	5.6	6.0	2.3	2.1	2.7	3.0	2.45	2.7
29	4.0	4.4	4.1	4.7	5.55	5.9	2.35	2.1	2.7	3.0	2.3	2.6
30	4.0	.....	4.05	4.6	5.5	5.75	2.5	2.1	2.7	3.0	2.6	2.7
31	3.9	.....	4.05	.....	5.6	.....	2.6	2.1	.....	.....	.....	2.6

NOTE.—There was little or no ice during 1907 or 1908. Gage heights July 12 to 24, 1908, were affected by backwater from the diversion dam and have been omitted. Gage heights for the two months previous are liable to be somewhat in error on this account. Gage heights beginning July 25 are for the new station above the old one.

Rating tables for Provo River above Telluride Power Company's dam near Provo, Utah.

JANUARY 1, 1906, TO JULY 11, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	153	4.60	544	5.60	1,020	6.60	1,560
3.60	181	4.70	588	5.70	1,070	6.70	1,620
3.70	210	4.80	634	5.80	1,120	6.80	1,680
3.80	240	4.90	680	5.90	1,175	6.90	1,740
3.90	272	5.00	726	6.00	1,230	7.00	1,800
4.00	305	5.10	774	6.10	1,285	7.20	1,920
4.10	340	5.20	822	6.20	1,340	7.40	2,040
4.20	378	5.30	870	6.30	1,395	7.60	2,160
4.30	418	5.40	920	6.40	1,450	7.80	2,280
4.40	458	5.50	970	6.50	1,505	8.00	2,400
4.50	500						

NOTE.—This table is not applicable for ice or obstructed-channel conditions below gage height 5.5 feet. It is based on 14 discharge measurements made during 1905-1907, and is fairly well defined between gage heights 3.7 feet and 5.5 feet. Above gage height 5.5 feet the rating curve is drawn to average the three measurements, two of which were probably made when the gage was affected by backwater from the diversion dam of the power flume. It is not the normal curve but probably gives the best average results.

JULY 25 TO DECEMBER 31, 1908.

2.00	210	2.50	292	3.00	382	3.50	476
2.10	225	2.60	310	3.10	400	3.60	495
2.20	241	2.70	328	3.20	419		
2.30	258	2.80	346	3.30	438		
2.40	275	2.90	364	3.40	457		

NOTE.—This table is not applicable for ice conditions. It is based on 2 discharge measurements made during 1908, and is not well defined. The rating curve is not a normal one as the measurement of October 30 was probably affected by backwater, but it is believed to represent average conditions as they existed during the period.

Monthly discharge of Provo River above Telluride Power Company's dam near Provo, Utah, for 1906–1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.[a]					
January	.....	.....	274	16,800	C.
February	340	153	250	13,900	B.
March	657	240	360	22,100	B.
April	774	340	527	31,400	B.
May	1,680	340	973	59,800	B.
June	1,860	500	1,090	64,900	B.
July	479	240	331	20,400	B.
August	359	210	260	16,000	B.
September	322	256	295	17,600	B.
October	272	240	258	15,900	B.
November	340	210	289	17,200	B.
December	479	240	320	19,700	B.
The year	1,860	153	436	316,000	
1907.					
January	340	196	280	17,200	C.
February	774	272	450	25,000	B.
March	750	322	460	28,300	B.
April	1,560	418	897	53,400	B.
May	2,340	634	1,170	71,900	C.
June	2,340	1,120	1,650	98,200	C.
July	2,100	479	1,120	68,900	C.
August	458	359	387	23,800	B.
September	500	359	400	23,800	B.
October	398	378	381	23,400	B.
November	378	378	378	22,500	B.
December	458	305	378	23,200	B.
The year	2,340	196	663	480,000	

[a] These discharges supersede those published in Water-Supply Paper 212, p. 39. Gage heights for 1906 are given in Water-Supply Paper 212, p. 38.

Monthly discharge of Provo River above Telluride Power Company's dam near Provo, Utah, for 1906–1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	378	240	329	20,200	C.
February	458	225	330	19,000	B.
March	458	322	372	22,900	B.
April	870	322	515	30,600	B.
May	1,070	500	886	54,500	C.
June	1,800	970	1,230	73,200	C.
July [a]	1,070	.....	579	35,600	C.
August	346	225	260	16,000	B.
September	364	225	253	15,100	B.
October	504	328	386	23,700	B.
November	382	258	364	21,700	C.
December	495	310	365	22,400	C.
The year	1,800	225	489	355,000	

[a] Discharges interpolated July 12 to 24.

PROVO RIVER AT MOUTH OF CANYON NEAR PROVO, UTAH.

This station, which was located about 6 miles above Provo and 1,200 feet above the power house of the Telluride Power Company, was established July 27, 1889, to determine the amount of water available at the mouth of the canyon for irrigating lands near Utah Lake, and was discontinued June 30, 1906. The station established February, 1905, 4 miles above the mouth of the canyon and above the dam of the Telluride Power Company, now furnishes the necessary data, the discharge being practically the same at the two points.

The discharge of the Telluride Power Company's flume has been added to that at the station to give the total of the river. Discharges were omitted from the 1906 report but are included here for comparative purposes. No discharge measurements were made in 1906.

Rating table for Provo River at mouth of canyon near Provo, Utah, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	7	4.20	177	5.10	589	6.00	1,192
3.40	12	4.30	212	5.20	649	6.10	1,265
3.50	20	4.40	250	5.30	711	6.20	1,340
3.60	31	4.50	290	5.40	775	6.30	1,415
3.70	46	4.60	332	5.50	841	6.40	1,490
3.80	64	4.70	377	5.60	910	6.50	1,565
3.90	87	4.80	425	5.70	980	6.60	1,640
4.00	114	4.90	477	5.80	1,050		
4.10	144	5.00	532	5.90	1,120		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1903–1905, and is well defined between gage heights 3.5 feet and 6.3 feet.

Daily discharge, in feet, of Telluride Power Company's flume near Provo, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	187	203	182	169	151	[a]138	16	165	189	152	179	169	136
2	168	204	185	150	160	[a]138	17	183	194	230	213	158	136
3	168	199	202	143	152	[a]137	18	198	205	179	156	142	123
4	182	218	146	182	173	133	19	150	186	177	166	143	139
5	189	200	194	238	185	145	20	125	202	158	142	142	134
6	154	199	194	187	145	33.3	21	152	154	172	140	153	139
7	182	201	195	171	161	126	22	193	182	172	112	150	152
8	147	200	181	189	177	158	23	191	192	166	145	146	142
9	140	192	190	164	174	143	24	188	190	162	142	146	132
10	142	192	171	197	148	122	25	184	164	168	148	157	142
11	180	194	188	154	167	143	26	188	163	145	143	157	152
12	189	182	183	165	145	147	27	203	184	164	172	132	150
13	184	195	58	163	155	129	28	192	195	164	133	166	145
14	180	195	190	181	193	139	29	205	.....	127	142	139	149
15	155	194	178	163	177	148	30	223	.....	152	179	145	166
							31	197	.....	167	.....	142	.....

[a] Interpolated.

NOTE.—These discharges are the mean of two readings, at 8 a. m. and 5 p. m., these being the hours at which the gage on the river was read. They are based on the electric output of the plant.

Monthly discharge of Provo River at mouth of canyon near Provo, Utah, for 1906.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	769	157	279	17,200	B.
February	340	214	264	14,700	B.
March	986	228	421	25,900	B.
April	920	392	637	37,900	B.
May	1,790	585	1,200	73,800	B.
June	2,090	712	1,240	73,800	B.
The period	.....	.....	.....	243,000	

NOTE.—Gage heights for 1906 are given in Water-Supply Paper 212, p. 39.

HOBBLE CREEK BASIN.

DESCRIPTION.

Hobble Creek rises on the western slope of the Wasatch Mountains and flows in a general southwesterly direction to Utah Lake. In the greater part of the basin the soil cover is very thin and supports but a scanty growth of timber and brush. The steep, narrow canyon in which the stream flows is broken here and there by narrow openings or flats, covered with a shallow deposit of bowlders and soil and comprising irrigated farms. As these tracts lie along the banks of the creek, a large part of the water used on them is returned to the stream as seepage. The creek has no important tributaries, but short intermittent streams which flow in steep, narrow canyons enter all along the course. No storage reservoirs, lakes, or marshes control the flood discharge, which occurs in the spring as a result of the melting snow. The entire normal summer flow is used for irrigation below the canyon.

Within the period for which records are available, the year of the greatest run-off was probably 1907, as on other streams in the vicinity, but records are not complete for that year. The driest year, according to the record at Springville, was 1905, when the discharge was 21,650 acre-feet.

Only one station has been maintained in this basin, that near Springville, Utah, 1904–1908.

HOBBLE CREEK NEAR SPRINGVILLE, UTAH.

This station, which is located about 1 mile above the mouth of the canyon, 4 miles southeast of Springville electric-power plant, was established March 23, 1904, to determine the total discharge of the creek available for irrigation in connection with the Strawberry Valley project of the United States Reclamation Service. The station is above all diversions and below all tributaries.

Practically no ice forms at the station, as the normal winter flow comes largely from springs. The channel is composed of loose, fine gravel and shifts almost constantly. As sufficient measurements can not as a rule be made to determine the amount of change, the results obtained are liable to considerable error. Discharges for 1906 and the early part of 1907 can not be computed because of insufficient data.

Discharge measurements of Hobble Creek near Springville, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 19	G. T. Burridge	16	26	2.21	118
July 8	do	17	23	2.00	78
July 27	La Rue and Burridge	17	16	1.60	49
August 21	do	16	16	1.45	42
1908.					
March 27	A. D. Williams	16.5	15	1.50	44
April 18	do	17	21	1.75	68
June 4	do	17	21	1.95	65

Daily gage height, in feet, of Hobble Creek near Springville, Utah, for 1907 and 1908.

[E. P. Noe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1				1.9		3.5	2.2			1.35		
2	1.55		1.75	2.2			2.2	1.6	1.5		1.3	1.35
3						3.5	2.1	1.55				
4		2.2	1.75			3.6	2.0	1.6	1.5	1.35	1.3	
5	1.55	3.75					2.0	1.6		1.35		
6		2.2	1.75			3.5	2.0	1.6	1.5	1.3		
7								1.6	1.5	1.3		1.35
8	1.55					3.5	2.0	1.6				
9		2.0	1.8					1.55	1.5	1.3	1.3	1.35
10						3.0	2.1	1.55	1.5			

Daily gage height, in feet, of Hobble Creek near Springville, Utah, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 07.												
11			1.75				2.1		1.45	1.35	1.35	
12	1.55	1.9				3.0	2.1	1.5	1.45	1.3		
13						3.0	2.0	1.5	1.5			
14			1.65			2.9		1.5		1.3		1.35
15	1.55	1.8				2.8	1.9	1.45				
16			1.7				1.9	1.4	1.45	1.3	1.35	
17						2.7		1.4	1.45			1.3
18	1.55		1.95			2.7	1.85	1.45		1.3	1.35	
19		1.7	2.2				1.8	1.4	1.4			
20			2.75			2.5	1.8	1.45	1.4			
21	1.5					2.5		1.45	1.4	1.25		
22						2.45	1.8	1.5				
23							1.75		1.4	1.2	1.35	
24						2.3		1.45	1.4			1.35
25	1.5		2.75			2.3	1.7			1.2		
26						2.25	1.7	1.4		1.25	1.35	
27			2.25			2.2	1.6	1.4	1.4			1.35
28						2.2			1.4	1.25		
29	1.55		1.9			2.2	1.6	1.45	1.35			
30							1.6		1.35	1.25	1.35	
31	1.55						1.6	1.45				1.35
1908.												
1	1.35			1.45	1.6	1.8	1.75	1.35	1.2	1.15		
2					1.6	1.8	1.75		1.2			1.35
3				1.45			1.7	1.35	1.25		1.35	
4			1.25	1.5	1.65	1.75		1.35				
5				1.65	1.6			1.35	1.2	1.2		
6		1.3				1.7	1.7	1.35			1.35	
7				1.6	1.65		1.65	1.35	1.2	1.25		
8				1.6	1.65	1.75	1.6	1.35	1.2			
9				1.5	1.6		1.55					1.35
10	1.35			1.6		1.8	1.55	1.3	1.2	1.2	1.35	
11			1.3	1.65	1.65		1.5	1.35	1.2			
12				1.7	1.65	2.0		1.3	1.2	1.2		
13		1.25		1.8	1.7	2.1	1.45	1.3				
14	1.3			1.85			1.45		1.2		1.35	
15				1.8	1.65	2.2		1.35	1.2			1.35
16				1.75	1.6	2.1	1.4		1.2			
17				1.75		2.0	1.45	1.3		1.2	1.35	
18			1.35	1.75	1.6	1.95	1.45		1.2			
19					1.55	1.85			1.2			
20	1.35	1.25		1.75		1.85	1.4	1.35				
21					1.55		1.4	1.3	1.2		1.4	
22				1.7	1.55	1.8	1.4	1.25	1.2			
23				1.85	1.55		1.4				1.35	1.35
24			1.3	1.75		1.75	1.4			1.2		
25	1.3			1.7	1.55	1.75	1.4	1.25	1.25			
26		1.25				1.7		1.25	1.2			
27			1.5	1.65	2.0	1.7	1.35	1.2		1.25		
28			1.4	1.6	2.0		1.35	1.2	1.2			1.35
29	1.3			1.6		1.75	1.35	1.2				
30			1.45	1.6	2.0	1.75	1.35		1.15			
31			1.45				1.35			1.3		

NOTE.—Floods March 21 to 24, 1907, and April 3 to 18, 1907, gage under water. Gage washed out April 19 1907, and new gage established June 1, 1907, with datum 2.0 feet lower than datum of old gage.

Rating table for Hobble Creek near Springfield, Utah, for June 1, 1907, to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	30	1.80	63	2.50	162	3.20	310
1.20	32	1.90	73	2.60	182	3.30	333
1.30	35	2.00	84	2.70	202	3.40	357
1.40	39	2.10	97	2.80	222	3.50	382
1.50	43	2.20	112	2.90	244	3.60	410
1.60	48	2.30	127	3.00	266		
1.70	55	2.40	144	3.10	288		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1907-8, and is fairly well defined between gage heights 1.45 feet and 2.2 feet. It is not well defined, however, for the last six months of 1908.

Monthly discharge of Hobble Creek near Springfield, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
June	410	112	240	14,300	D.
July	112	48	73.9	4,540	C.
August	48	39	43.0	2,640	C.
September	43	37	40.9	2,430	C.
October	37	32	34.6	2,130	C.
November	37	35	36.3	2,160	C.
December	37	35	36.7	2,260	C.
The period				30,500	
1908.					
January	37	35	36.0	2,210	C.
February	35	34	34.3	1,970	C.
March	43	34	36.2	2,230	C.
April	68	41	53.1	3,160	C.
May	84	46	54.2	3,330	C.
June	112	55	68.3	4,060	D.
July	59	37	43.8	2,690	D.
August	37	32	35.1	2,160	D.
September	34	31	32.2	1,920	D.
October	35	31	32.7	2,010	D.
November	39	35	37.3	2,220	D.
December	39	37	37.3	2,290	D.
The year	112	31	41.7	30,200	

NOTE.—Discharges interpolated on days when gage was not read. There is not sufficient data for computing discharges for the first half of 1907.

SPANISH FORK BASIN.

DESCRIPTION.

Spanish Fork rises in the Wasatch Mountains and flows northwestward into Utah Lake. The area is generally barren and supports but very little timber or brush. The stream is confined to a steep, narrow canyon, with a very few small openings in which are irrigated farms. The tributaries are all short and many of them are intermittent. The most important, Diamond Fork and Thistle Creek, enter, respectively, about 8 and 10 miles above the gaging station, near Spanish Fork, and like the main stream occupy narrow,

steep-walled canyons. The normal flow comes largely from springs scattered over the entire basin; the flood discharge is direct surface run-off from melting snow.

No storage reservoirs are used on the stream. The entire normal low-water flow is diverted at the mouth of the canyon and used for irrigating lands near Utah Lake.

The stream at present is used for power development at one plant installed in 1908 by the United States Reclamation Service, near the mouth of the canyon. (See Pl. III, *B*.)

During the period for which records are available the wettest year was 1907, when discharge at the station at the mouth of the canyon, near Spanish Fork, was 203,000 acre-feet, of which 98,500 acre-feet wasted into Utah Lake, according to the records at the Lake Shore station. The driest year according to the above records was 1905, when 65,810 acre-feet was discharged at the mouth of the canyon, of which 19,230 acre-feet wasted into the lake.

The following stations have been maintained in this basin:

SpanishFork at Thistle, Utah, 1908.
Spanish Fork near Spanish Fork, Utah, 1900–1908.
Spanish Fork near Mapleton, Utah, 1900–1901.
Spanish Fork near Lake Shore, Utah, 1903–1907.
Diamond Fork near Thistle, Utah, 1908.

SPANISH FORK AT THISTLE, UTAH.

This station, which was established December 3, 1907, is located one-half mile below Thistle station on the Denver and Rio Grande Railroad, just below the mouth of Thistle Creek and about 2 miles above the mouth of Diamond Fork. Gage height records began January 11, 1908.

The flow is uninfluenced by diversion or storage. The gage heights are often affected by ice during the winter. The section is permanent except during extreme floods and results for the open-water period are good.

Discharge measurements of Spanish Fork at Thistle, Utah, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	A. D. Williams	35	29	3.20	59
April 15	do	34	34	3.40	85
June 2	do	34	46.8	3.72	142
June 26	do	35	31	3.27	73
August 27	E. A. Porter	31	19	2.85	33
September 24	La Rue and Lytel	35	55	3.95	192
October 16	E. C. La Rue	33	26	3.05	52
October 29 [a]	do	32	24	3.00	44

[a] Wading measurement.

Daily gage height, in feet, of Spanish Fork at Thistle, Utah, for 1908.

[United States Reclamation Service, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.2	3.25	3.2	3.45	3.75	3.2	3.2	2.9	2.9	3.0	3.0
2	.....	3.2	3.2	3.2	3.45	3.7	3.2	3.2	2.9	2.9	3.0	3.0
3	.....	3.2	3.0	3.2	3.5	3.7	3.2	3.2	2.9	3.0	3.0	3.0
4	.....	3.25	3.3	3.2	3.5	3.7	3.2	3.2	2.9	2.9	3.0	3.05
5	.....	3.2	3.3	3.2	3.55	3.65	3.2	4.8	2.9	2.9	3.0	3.05
6	.....	3.2	3.2	3.25	3.55	3.65	3.2	3.1	2.9	2.9	3.0	3.0
7	.....	3.2	3.25	3.1	3.5	3.65	3.2	3.1	2.9	2.9	3.0	3.0
8	.....	3.4	3.2	3.05	3.5	3.65	3.2	3.1	2.9	2.9	3.0	2.9
9	.....	3.2	3.1	3.2	3.7	3.65	3.2	3.05	3.5	2.9	3.0	2.9
10	.....	3.25	3.1	3.3	3.6	3.65	3.15	3.75	3.0	2.9	3.0	3.0
11	3.4	3.2	3.2	3.35	3.65	3.65	3.15	3.2	3.7	2.9	3.0	3.05
12	3.3	3.2	3.2	3.35	3.65	3.6	3.15	3.2	3.0	2.9	3.0	3.05
13	3.4	3.2	3.25	3.35	3.7	3.55	3.5	3.15	3.0	2.9	3.0	3.0
14	3.3	3.2	3.3	3.4	3.7	3.55	3.25	3.15	3.0	2.9	3.0	3.0
15	3.2	3.3	3.4	3.4	3.7	3.5	3.2	3.1	3.0	3.0	3.0	3.05
16	3.2	3.4	3.5	3.4	3.7	3.5	3.15	3.05	3.0	3.0	3.0	3.1
17	3.4	3.3	3.5	3.4	3.75	3.5	3.15	3.05	3.0	3.0	3.0	3.15
18	3.4	3.3	3.45	3.5	3.8	3.6	3.15	3.0	2.9	3.0	3.0	3.2
19	3.3	3.1	3.3	3.5	3.8	3.5	3.1	3.0	2.9	3.1	3.0	3.25
20	3.2	3.3	3.2	3.45	3.75	3.45	3.1	3.0	2.9	3.1	3.0	3.4
21	3.2	3.3	3.1	3.5	3.7	3.45	3.1	3.35	2.9	3.0	3.0	3.6
22	3.2	3.4	3.2	3.5	3.7	3.4	3.1	3.0	2.9	3.0	3.0	3.7
23	3.2	3.4	3.2	3.5	3.75	3.4	3.1	3.0	3.0	3.0	3.0	3.9
24	3.2	3.25	3.25	3.5	3.75	3.35	3.05	2.9	4.0	3.0	3.0	4.0
25	3.2	3.2	3.25	3.5	3.75	3.35	3.05	2.9	3.1	3.0	3.0	4.1
26	3.2	3.3	3.2	3.4	3.75	3.3	3.05	2.9	3.0	3.0	3.0	4.3
27	3.2	3.2	3.2	3.25	3.8	3.3	3.05	2.9	3.0	3.0	3.1	4.8
28	3.2	3.25	3.2	3.2	3.75	3.25	5.25	2.9	2.9	3.0	3.05	5.4
29	3.2	3.3	3.2	3.4	3.75	3.25	4.7	2.9	2.9	3.0	3.0	5.6
30	3.2	.....	3.25	3.4	3.75	3.25	3.5	2.9	2.9	3.0	3.0	3.6
31	3.1	.....	3.25	.....	3.75	.....	3.2	2.9	.....	3.0	.....	3.6

NOTE.—The river was frozen over December 21 to 31 and the gage heights were probably affected by ice December 10 to 20.

Rating table for Spanish Fork at Thistle, Utah, for January 1 to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	14	3.30	73	4.10	230	4.90	470
2.60	17	3.40	86	4.20	257	5.00	502
2.70	22	3.50	101	4.30	285	5.10	534
2.80	29	3.60	118	4.40	315	5.20	566
2.90	37	3.70	137	4.50	345	5.30	598
3.00	45	3.80	157	4.60	376		
3.10	54	3.90	179	4.70	407		
3.20	63	4.00	203	4.80	438		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during 1908, and is well defined.

Monthly discharge of Spanish Fork at Thistle, Utah, for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January 11-31	86	54	68.4	2,850	A.
February	86	54	69.0	3,970	A.
March	101	45	68.2	4,190	A.
April	101	50	79.9	4,750	A.
May	157	94	132	8,120	A.
June	147	68	106	6,310	A.
July	582	50	88.0	5,410	A.
August	438	37	66.0	4,060	A.
September	203	37	51.2	3,050	A.
October	54	37	42.2	2,590	A.
November	54	45	45.5	2,710	A.
December	.....	.....	37.7	2,320	C.
The period	.....	.....	.....	50,300	

NOTE.—Discharge estimated December 10 to 31.

SPANISH FORK NEAR SPANISH FORK, UTAH.

This station, which is located 600 feet above the dam of the East Bench Irrigation Company, 5 miles southeast of Spanish Fork, was established May 23, 1900, discontinued November 30, 1901, and reestablished March 26, 1903, to determine the total water supply from Spanish Fork available for irrigating lands near Utah Lake. The records are of special importance to the United States Reclamation Service in connection with Strawberry Valley storage reservoir project.

The station is below all tributaries and above practically all diversions except the Reclamation Service power canal, which diverted some water past the station during the last part of 1908.

Results at the station are little affected by ice, the river freezing only in exceptionally cold weather. The bed of the stream is composed of sand and gravel, and as the current is swift, especially at high water, the channel is somewhat shifting. Satisfactory results, however, have usually been obtained.

Discharge measurements of Spanish Fork near Spanish Fork, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 28	La Rue and Burridge	42	142	3.30	892
June 17	G. T. Burridge	39	107	2.35	598
June 20	do	39	103	2.25	520
July 5	do	36	64	1.37	248
July 9	do	36	56	1.18	209
July 25	do	36	51	.95	165
August 21	LaRue and Burridge	35	40	.70	123
November 14	E. C. La Rue	35	30	.49	82
1908.					
January 30	A. D. Williams	36	36	.60	106
January 31	do	36	29	.45	83
March 26	do	36	36	.65	110
April 17	do	36	42	.90	141
June 3	do	37	54	1.30	212
October 29	E. C. La Rue	36	36	.75	109

Daily gage height, in feet, of Spanish Fork near Spanish Fork, Utah, for 1907 and 1908.

[United States Reclamation Service, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.3	1.35	1.7	2.25	3.45	3.35	1.5	0.9	0.8	0.75	0.65	0.55
2	1.15	1.35	1.7	2.3	3.4	3.55	1.5	.9	.8	.8	.65	.5
3	1.1	1.6	1.7	2.5	3.2	3.8	1.4	1.1	.75	.8	.65	.5
4	1.15	1.7	1.7	2.7	3.15	3.95	1.35	1.0	.75	.75	.65	.55
5	1.2	3.7	1.7	2.75	3.2	4.05	1.3	.95	.9	.75	.65	.55
6	1.3	2.7	1.7	2.7	3.25	3.9	1.2	.9	.85	.8	.65	.55
7	1.2	2.1	1.65	2.7	3.25	3.75	1.2	.9	.85	.75	.65	.65
8	1.2	1.7	1.65	2.7	3.2	3.65	1.2	.9	.8	.7	.65	.5
9	1.3	1.55	1.65	2.8	3.2	3.35	1.2	.85	.8	.7	.65	.5
10	1.25	1.65	1.65	3.2	3.3	3.15	1.2	.75	.8	.7	.65	.45
11	1.25	1.65	1.65	3.6	3.75	2.95	1.1	.75	.75	.7	.65	.6
12	1.2	1.6	1.9	3.8	3.9	2.95	1.1	.75	.7	.7	.6	.6
13	1.3	1.55	1.9	4.1	4.35	2.95	1.1	.75	.7	.7	.45	.55
14	1.3	1.55	1.65	4.5	3.65	2.6	1.15	.75	.7	.7	.5	.55
15	1.3	1.5	1.7	4.5	3.6	2.5	1.05	.8	.7	.7	.55	.55
16	1.3	1.5	1.7	4.2	3.5	2.5	1.05	.8	.7	.7	.5	.55
17	1.3	1.55	1.75	3.85	3.7	2.35	1.0	.75	.7	.7	.5	.55
18	1.25	1.7	1.8	3.65	4.1	2.3	.95	1.0	.7	.75	.6	.5
19	1.3	1.65	1.8	3.5	4.5	2.25	.95	.85	.7	.7	.6	.5
20	1.2	1.6	1.9	3.2	5.4	2.25	.95	.8	.7	.7	.6	.5
21	1.1	1.6	2.2	3.1	6.0	2.15	1.0	.75	.65	.7	.55	.5
22	1.15	1.65	2.5	3.0	5.8	2.0	1.0	.9	.65	.65	.5	.5
23	1.2	2.0	2.5	2.9	4.7	1.95	.95	.85	.65	.65	.5	.6
24	1.2	1.8	2.4	3.05	4.4	1.75	.9	.85	.65	.65	.55	.55
25	1.3	1.7	2.2	3.1	4.5	1.7	.95	.85	.65	.65	.5	.55
26	1.3	1.7	2.2	3.1	.....	1.65	1.0	.9	.65	.65	.5	.6
27	1.3	1.7	2.2	3.5	.....	1.65	1.0	.8	.65	.65	.5	.65
28	1.3	1.8	2.05	3.9	3.3	1.6	1.05	.8	.7	.65	.55	.65
29	1.3	.....	2.0	3.8	.....	1.6	1.0	.8	.7	.65	.6	.6
30	1.3	.....	2.1	3.5	3.05	1.55	.95	1.0	.75	.65	.5	.55
31	1.35	.....	2.1	.....	3.1	.....	.9	.85	.....	.7	.....	.55
1908.												
1	.5	.35	.6	.6	.8	1.3	.7	.8	.45	.5	.55	.4
2	.5	.4	.6	.6	.85	1.3	.7	.7	.45	.55	.55	.5
3	.5	.5	.6	.6	.9	1.3	.65	.7	.5	.6	.6	.5
4	.5	.6	.65	.6	1.6	1.3	.65	.6	.5	.6	.55	.5
5	.45	.5	.75	.6	.95	1.3	.65	.9	.5	.6	.55	.55
6	.45	.35	.55	.7	.95	1.3	.65	.75	.5	.55	.55	.55
7	.45	.45	.35	.7	1.0	1.3	.65	.65	.5	.55	.55	.4
8	.45	.5	.55	.65	1.05	1.25	.65	.6	.55	.55	.55	.4
9	.45	.55	.5	.65	1.15	1.25	.65	.6	.5	.5	.55	.4
10	.4	.55	.5	.7	1.1	1.25	.65	.55	.5	.5	.55	.45
11	.4	.6	.5	.85	1.1	1.25	.65	.75	.65	.5	.55	.45
12	.35	.55	.6	.85	1.1	1.25	.65	.65	.7	.5	.55	.4
13	.35	.4	.65	.85	1.15	1.15	.65	.6	.6	.5	.55	.4
14	.4	.2	.7	.9	1.1	1.1	.7	.6	.55	.5	.55	.35
15	.5	.3	.8	.9	1.15	1.1	.7	.55	.5	.5	.55	.35
16	.45	.4	.9	.95	1.15	1.1	.65	.55	.5	.65	.45	.35
17	.45	.55	.95	.9	1.15	1.1	.65	.55	.5	.6	.45	.35
18	.45	.5	.9	.9	1.2	1.4	.6	.55	.5	.55	.45	.35
19	.5	.35	.75	.95	1.25	1.2	.55	.5	.5	.65	.45	.3
20	.5	.5	.7	.95	1.3	1.1	.55	.5	.45	.65	.55	.....
21	.5	.4	.65	.95	1.25	1.0	.55	.5	.45	.6	.55	.....
22	.5	.5	.6	.95	1.2	1.0	.55	.6	.45	.6	.5	.....
23	.5	.65	.65	1.1	1.15	1.0	.55	.55	.45	.6	.5	.....
24	.55	.6	.65	1.0	1.1	.9	.55	.5	1.1	.6	.6	.....
25	.55	.6	.7	.95	1.1	.85	.5	.5	.85	.6	.65	.....
26	.55	.6	.7	.85	1.25	.8	.6	.5	.6	.55	.55	.....
27	.5	.6	.65	.85	1.25	.8	.55	.5	.6	.6	.4	.....
28	.5	.65	.65	.85	1.25	.75	1.1	.45	.55	.6	.35	.....
29	.5	.65	.65	.8	1.25	.75	1.7	.45	.55	.55	.4	.....
30	.55	.....	.65	.8	1.25	.7	.7	.4	.55	.55	.4	.....
31	.45	.....	.7	.....	1.3	.....	.7	.45	.....	.55	.....	.....

NOTE.—The river was frozen over December 18 to 31, 1908; there was probably not much ice at other times.

Rating tables for Spanish Fork near Spanish Fork, Utah.

JUNE 2, 1906, TO MAY 19, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	52	1.90	203	2.80	439	3.70	684
1.10	62	2.00	227	2.90	466	3.80	712
1.20	74	2.10	252	3.00	493	3.90	740
1.30	88	2.20	277	3.10	520	4.00	768
1.40	104	2.30	304	3.20	547	4.20	824
1.50	120	2.40	331	3.30	574	4.40	880
1.60	138	2.50	358	3.40	601	4.60	936
1.70	158	2.60	385	3.50	629		
1.80	180	2.70	412	3.60	657		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1906, and is not well defined.

MAY 20, 1907, TO APRIL 10, 1908.

0.20	46	1.50	280	2.80	715	4.20	1,250
.30	57	1.60	308	2.90	750	4.40	1,330
.40	70	1.70	338	3.00	785	4.60	1,410
.50	84	1.80	368	3.10	820	4.80	1,490
.60	100	1.90	400	3.20	855	5.00	1,570
.70	117	2.00	435	3.30	890	5.20	1,650
.80	136	2.10	470	3.40	930	5.40	1,730
.90	156	2.20	505	3.50	970	5.60	1,810
1.00	176	2.30	540	3.60	1,010	5.80	1,890
1.10	196	2.40	575	3.70	1,050	6.00	1,970
1.20	216	2.50	610	3.80	1,090		
1.30	236	2.60	645	3.90	1,130		
1.40	256	2.70	680	4.00	1,170		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 11 discharge measurements made during the period covered, and is well defined between gage heights 0.5 foot and 3.5 feet.

APRIL 11 TO DECEMBER 31, 1908.

0.20	39	0.60	87	1.00	154	1.40	240
.30	49	.70	102	1.10	174	1.50	264
.40	60	.80	118	1.20	195	1.60	290
.50	73	.90	135	1.30	217	1.70	318

NOTE—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908–9 and the form of the previous curve, and is well defined between gage heights 0.6 foot and 1.3 feet.

Monthly discharge of Spanish Fork near Spanish Fork, Utah, for 1907 and 1908.

[Drainage area, 670 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	96	62	80.8	0.121	0.14	4,970	C.
February	684	96	178	.266	.28	9,890	C.
March	358	148	207	.309	.36	12,700	C.
April	908	290	571	.852	.95	34,000	C.
May	1,970	534	889	1.33	1.53	54,700	C.
June	1,190	294	674	1.01	1.13	40,100	B.
July	280	156	197	.294	.34	12,100	A.
August	196	126	147	.219	.25	9,040	A.
September	156	108	122	.182	.20	7,260	A.
October	136	108	118	.176	.20	7,260	A.
November	108	77	96.3	.144	.16	5,730	B.
December	108	77	92.0	.137	.16	5,660	B.
The year	1,970	62	281	.420	5.70	203,000	

Monthly discharge of Spanish Fork near Spanish Fork, Utah, for 1907 and 1908—Con.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	92	64	80.4	0.120	0.14	4,940	B.
February	108	46	84.4	.126	.14	4,850	B.
March	166	64	110	.164	.19	6,760	B.
April	174	100	126	.188	.21	7,500	B.
May	290	118	180	.269	.31	11,100	A.
June	240	102	177	.264	.29	10,500	A.
July	318	73	101	.151	.17	6,210	B.
August	135	60	85.0	.127	.15	5,230	B.
September	174	66	81.0	.121	.14	4,820	B.
October	94	73	82.0	.122	.14	5,040	B.
November	94	54	75.7	.113	.13	4,500	B.
December	.....	.....	57.6	.086	.10	3,540	C.
The year	318	.....	103	.154	2.11	75,000	

NOTE.—Discharge estimated December 18 to 31, 1908.

SPANISH FORK NEAR LAKE SHORE, UTAH.

This station, which was located about 3 miles west of the town of Spanish Fork and about 3 miles from Utah Lake, was established December 10, 1903, to determine the amount of unappropriated run-off discharged into Utah Lake, and was discontinued July 10, 1907. The entire normal summer flow is diverted above the station, and the stream is dry from some time in June and July until about December 1.

The records have been little affected by ice. The bed is of a very shifting character and results have been rather unsatisfactory. Gage heights prior to May 26, 1904, were observed on a gage just below the bridge on the highway from Spanish Fork to Lake Shore. After that time they were read from a gage at the cable, 800 feet above the bridge. All gage heights for 1904 have been reduced to corresponding readings on the old gage.

Discharge measurements of Spanish Fork near Lake Shore, Utah, in 1907.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
1907.		*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 17	G. T. Burridge	126	7.75	382
July 5	do	10	4.85	13
July 24	do	4	4.50	0.4

Daily gage height, in feet, of Spanish Fork near Lake Shore, Utah, for 1907.

[L. P. Larsen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.9	5.1	5.5	6.2	8.35	8.35	5.1	16	5.0	5.4	5.6	9.5	8.85	8.0	.....
2	4.9	5.1	5.5	6.4	8.35	8.35	5.0	17	5.0	5.5	6.0	9.35	9.25	7.8	.....
3	4.8	5.6	5.5	6.8	8.35	8.5	5.0	18	5.0	5.5	6.2	8.65	9.25	7.6	.....
4	4.8	6.8	5.5	7.4	8.35	8.5	4.8	19	5.0	5.5	6.5	8.5	9.25	7.4	.....
5	4.8	8.0	5.5	7.4	8.25	8.5	4.8	20	4.9	5.5	6.7	8.5	9.5	7.3	.....
6	4.85	7.7	5.5	7.2	8.25	8.5	4.8	21	4.9	5.5	6.8	8.65	9.65	6.6	.....
7	4.85	6.3	5.5	7.0	8.25	8.5	4.8	22	4.9	5.6	6.9	8.65	9.4	6.5	.....
8	4.9	5.7	5.5	7.3	8.0	8.5	4.8	23	4.9	5.6	6.9	8.65	9.2	6.5	.....
9	4.85	5.6	5.5	7.8	8.0	8.35	4.8	24	4.8	5.6	6.8	8.85	9.0	6.4	.....
10	4.9	5.5	5.5	8.0	8.0	8.2	.....	25	4.8	5.6	6.7	8.85	8.8	6.3	.....
11	4.9	5.5	5.5	8.35	8.0	8.2	.....	26	4.9	5.6	6.6	8.85	8.6	5.9	.....
12	5.0	5.5	5.6	9.0	8.65	8.8	.....	27	4.9	5.6	6.4	8.85	8.4	5.8	.....
13	5.0	5.4	5.6	9.3	8.65	8.8	.....	28	5.0	5.6	6.2	8.6	8.2	5.7	.....
14	5.0	5.4	5.6	9.5	8.5	8.6	.....	29	5.0	.....	6.1	8.6	8.2	5.6	.....
15	5.0	5.4	5.6	9.5	8.5	8.6	.....	30	5.0	.....	6.0	8.5	8.0	5.4	.....
								31	5.1	.....	6.0	.....	8.0	.....	.....

NOTE.—Spanish Fork was practically dry after July 9 until late in fall.

Daily discharge, in second-feet, of Spanish Fork near Lake Shore, Utah, for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	63	80	116	192	488	452	24	16	71	106	126	590	512	410	.....
2	63	80	116	216	488	452	19	17	71	116	169	572	560	386	.....
3	55	126	116	265	488	470	19	18	71	116	192	488	560	354	.....
4	55	265	116	338	488	470	11	19	71	116	228	470	560	316	.....
5	55	410	116	338	440	470	11	20	63	116	252	470	590	298	.....
6	59	375	116	314	440	470	11	21	63	116	265	488	608	176	.....
7	59	204	116	289	440	470	11	22	63	126	277	488	578	161	.....
8	63	137	116	326	410	470	11	23	63	126	277	488	554	161	.....
9	59	126	116	387	410	452	11	24	55	126	265	512	530	146	.....
10	53	116	116	410	410	434	.....	25	55	126	252	512	506	132	.....
11	53	116	116	452	410	434	.....	26	63	126	240	512	482	83	.....
12	71	116	126	530	488	506	.....	27	63	126	216	512	458	73	.....
13	71	106	126	566	488	506	.....	28	71	126	192	482	434	64	.....
14	71	106	126	590	470	482	.....	29	71	.....	180	482	434	56	.....
15	71	106	126	590	470	482	.....	30	71	.....	168	470	410	41	.....
								31	80	.....	168	.....	410	.....	.....

NOTE.—These discharges were obtained from two rating tables which are very poorly defined.

Monthly discharge of Spanish Fork near Lake Shore, Utah, for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	80	53	64.1	3,940	D.
February	410	80	144	8,000	C.
March	277	116	169	10,400	C.
April	590	192	445	26,500	C.
May	608	410	484	29,800	C.
June	506	41	329	19,600	C.
July 1-9	24	.....	14.2	254	D.
The period	.....	.....	.....	98,500	

DIAMOND FORK NEAR THISTLE, UTAH.

Diamond Fork (also known as North Fork) is tributary to Spanish Fork about 2 miles below the mouth of Thistle Creek. The gaging station, which was established December 2, 1907, is located about one-fourth mile above the mouth.

The Strawberry Valley tunnel will discharge into the headwaters at an elevation of nearly 7,500 feet. At present the run-off at the station is unaffected either by diversion or storage. Results are rendered somewhat inaccurate by shifting channel, and during the winter by ice.

Discharge measurements of Diamond Fork near Thistle, Utah, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	A. D. Williams	20.0	18.0	3.12	19.6
March 26	do	20.0	20.0	3.25	26.5
April 16	do	19.5	20.0	3.35	32.0
June 2	do	20.0	24.0	3.50	47.3
June 27	do	19.5	21.0	3.37	34.0
August 27	E. A. Porter	18.0	14.7	3.00	14.0
September 22	E. C. La Rue	18.4	13.0	3.00	11.0
October 13	do	19.7	15.1	3.08	14.3
October 29	do	19.7	14.0	3.10	14.1

Daily gage height, in feet, of Diamond Fork near Thistle, Utah, for 1908.

[United States Reclamation Service, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.15	3.15	3.2	3.35	3.45	3.35	3.15	3.0	3.0	3.0	3.0
2	.....	3.1	3.15	3.2	3.35	3.5	3.35	3.15	3.0	3.0	3.0	3.0
3	.....	2.9	3.15	3.2	3.4	3.5	3.3	3.15	3.0	3.1	3.0	3.05
4	.....	3.2	3.25	3.25	3.4	3.5	3.25	3.15	3.0	3.1	3.0	3.1
5	.....	3.25	3.25	3.3	3.45	3.5	3.25	3.2	3.0	3.1	3.0	3.05
6	.....	3.3	3.2	3.3	3.4	3.45	3.2	3.2	3.0	3.1	3.0	3.05
7	.....	3.1	3.2	3.3	3.35	3.45	3.2	3.2	3.0	3.1	3.0	3.05
8	.....	3.25	3.0	3.25	3.35	3.45	3.2	3.15	3.0	3.1	3.0	3.05
9	.....	3.1	2.95	3.25	3.4	3.45	3.15	3.1	3.0	3.1	3.0	3.05
10	.....	3.15	3.2	3.25	3.45	3.45	3.15	3.1	3.0	3.1	3.0	3.05
11	2.9	3.1	3.2	3.3	3.45	3.5	3.15	3.3	3.0	3.1	3.0	3.05
12	2.9	3.0	3.2	3.35	3.45	3.55	3.1	3.15	3.0	3.1	3.0	3.05
13	2.9	3.0	3.2	3.35	3.5	3.55	3.3	3.1	3.0	3.1	3.0	3.0
14	2.9	3.2	3.2	3.4	3.45	3.55	3.25	3.1	3.0	3.1	3.0	2.9
15	3.05	3.25	3.25	3.4	3.4	3.55	3.2	3.1	3.0	3.1	3.0	2.9
16	2.95	3.2	3.3	3.35	3.4	3.6	3.15	3.1	3.0	3.1	3.0	2.9
17	2.9	3.3	3.3	3.4	3.4	3.6	3.15	3.1	3.0	3.1	3.0	2.95
18	3.0	3.2	3.3	3.4	3.4	3.6	3.15	3.1	3.0	3.1	3.0	3.0
19	3.05	3.25	3.2	3.35	3.4	3.55	3.15	3.1	3.0	3.1	3.0	3.05
20	2.95	3.25	3.2	3.4	3.45	3.5	3.15	3.1	3.0	3.1	3.0	3.1
21	2.9	3.2	3.25	3.4	3.45	3.45	3.15	3.05	3.0	3.1	3.0	3.2
22	2.95	3.15	3.2	3.4	3.45	3.4	3.15	3.05	3.0	3.1	3.0	3.1
23	3.0	3.2	3.2	3.5	3.4	3.4	3.15	3.0	3.0	3.1	3.0	3.1
24	3.2	3.15	3.25	3.45	3.4	3.4	3.15	3.0	3.4	3.1	3.0	3.2
25	3.1	3.2	3.3	3.4	3.4	3.45	3.15	3.0	3.2	3.1	3.0	3.3
26	3.1	3.2	3.2	3.35	3.45	3.4	3.15	3.0	3.0	3.1	3.0	3.2
27	3.2	3.2	3.25	3.3	3.55	3.4	3.2	3.0	3.0	3.05	3.05	3.1
28	3.1	3.2	3.2	3.3	3.5	3.4	3.3	3.0	3.0	3.05	3.05	3.0
29	3.1	3.2	3.2	3.3	3.45	3.35	3.2	3.0	3.0	3.0	3.0	2.9
30	3.1	.....	3.2	3.35	3.45	3.35	3.15	3.0	3.0	3.0	3.0	2.9
31	3.0	.....	3.2	.....	3.45	.....	3.2	3.0	.....	3.0	.....	2.9

NOTE.—Ice conditions December 19 to 28.

Daily discharge, in second-feet, of Diamond Fork near Thistle, Utah, for 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	21	20	22	32	42	32	19	13	12	12	13
2	.....	18	20	22	32	47	32	19	13	12	12	13
3	.....	12	20	22	37	47	28	19	13	15	12	14
4	.....	24	27	26	37	47	24	19	13	15	12	16
5	.....	28	27	30	42	47	24	22	13	15	12	14
6	.....	33	23	30	37	42	21	22	13	15	12	14
7	.....	18	23	29	32	42	21	22	13	15	12	14
8	.....	28	14	25	32	42	21	19	12	15	12	14
9	.....	18	12	25	37	42	18	16	12	15	12	14
10	.....	21	23	25	42	42	18	16	12	15	12	14
11	11	18	23	28	42	47	18	19	12	15	12	14
12	11	14	23	32	42	53	16	19	12	15	12	14
13	11	14	22	32	47	53	28	17	12	15	12	13
14	11	24	23	37	42	53	24	17	12	15	12	11
15	14	28	27	37	37	53	21	17	12	15	12	11
16	12	24	31	32	37	59	18	17	12	15	12	11
17	11	32	31	37	37	59	18	17	12	15	12	12
18	13	24	31	37	37	59	18	17	11	15	12	11
19	14	28	23	32	37	53	18	17	11	15	12	11
20	12	28	23	37	42	47	18	17	11	15	12	11
21	11	24	27	37	42	42	19	15	11	15	12	11
22	12	21	23	37	42	37	19	15	11	15	12	11
23	13	24	23	47	37	37	19	14	11	15	12	11
24	21	20	27	42	37	37	19	14	37	15	12	11
25	16	24	31	37	37	42	19	14	23	15	12	11
26	16	24	23	32	42	37	19	14	11	15	12	11
27	21	24	26	28	53	37	22	14	11	13	14	11
28	16	24	23	28	47	37	28	14	12	13	14	11
29	16	24	23	28	42	32	22	14	12	12	12	11
30	20	.....	23	32	42	32	19	14	12	12	13	11
31	14	.....	22	.....	42	.....	22	14	.....	12	.....	11

NOTE.—These discharges were obtained by the indirect method for shifting channels, except December 19 to 28, which were estimated.

Monthly discharge of Diamond Fork near Thistle, Utah, for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January 11–31	21	11	14.1	587	B.
February	33	12	22.9	1,320	B.
March	31	12	23.8	1,460	B.
April	47	22	31.5	1,870	B.
May	53	32	39.5	2,430	B.
June	59	32	44.9	2,670	B.
July	32	16	21.4	1,320	B.
August	22	14	16.9	1,040	B.
September	37	11	13.2	786	B.
October	15	12	14.4	885	B.
November	14	12	12.2	726	B.
December	.....	.....	12.3	756	C.
The period	.....	.....	.....	15,800	

SEVIER RIVER BASIN.

DESCRIPTION.

Sevier River is formed by the junction of South and East forks, which rise in Garfield and Kane counties in southern Utah and meet near Junction. The river flows northeastward to a point near Gunnison, northwestward nearly to Leamington, and then turns sharply

to the southwest and discharges into Sevier Lake. It is more than 200 miles long, measured by general course, and drains an area of about 5,000 square miles above the lower end of Sevier Valley.

The river occupies a long, narrow basin and receives few tributaries, San Pitch River and Salina Creek being the most important. Salina Creek, which enters about 15 miles above Gunnison, is characterized by rapid run-off and during flood season carries an immense amount of sediment.

The San Pitch joins the Sevier near Gunnison below the gaging station on the main stream. Its flow is controlled by a storage reservoir about 15 miles above the mouth and is used for irrigating small tracts along the river. Manti Creek, its principal tributary, which enters above the reservoir, drains a barren area and has a rapid run-off.

Considerable irrigation is practiced from the Sevier above Gunnison, and the flow is controlled by a few small storage reservoirs.

The wettest year in the basin since 1900 was 1907 and the driest was 1902, the ratios of discharge for the two years being about 11 to 1.

The following gaging stations have been manitained in this basin:

Sevier River near Marysvale, Utah, 1906–1908.
Sevier River near Gunnison, Utah, 1900–1908.
Salina Creek near Salina, Utah, 1900.
San Pitch River near Gunnison, Utah, 1900–1905.
Manti Creek near Manti, Utah, 1900.

SEVIER RIVER NEAR MARYSVALE, UTAH.

This station, which was established February 18, 1906, to determine the amount of water available for irrigation and storage in the upper valley of Sevier River, is located about 6 miles above Marysvale, the nearest railroad station, and about 10 miles below the junction of South and East forks.

A gage for high-water records was established May 23, 1906, at a different datum from that of the regular gage and was read until June 9, and for a few days thereafter. All gage heights have been reduced to the datum of the regular gage.

The results are somewhat affected by ice during severe weather, but are otherwise fairly reliable. The stream bed is of clay and will shift occasionally at high water. Gage-height records have not been obtained continuously.

Discharge measurements of Sevier River near Marysvale, Utah, in 1906 to 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 24	H. S. Kleinschmidt	55	221	4.85	673
July 19	T. Greive, jr	49	128	[a] 3.01	260
1907.					
June 1	G. T. Burridge	60	383	6.40	1,230
July 12	do	50	146	3.30	302
July 30	do	51	154	3.80	397
August 24	La Rue and Burridge	53	195	4.25	537
1908.					
April 14	A. D. Williams	53	176	4.30	480
June 5	do	52	139	3.35	326
June 24	do	51	95	2.70	196

[a] Reduced to datum of regular gage. The gage height as given in Water-Supply Paper 212, p. 47, was referred to the temporary gage.

Daily gage height, in feet, of Sevier River near Marysvale, Utah, for 1906 to 1908.

[Mrs. Martha Pitts, observer.]

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1906.[a]				1906.[a]				1906.[a]			
1		3.5	3.0	11		2.4		21		4.15	
2		3.5	4.0	12		2.5		22		4.0	
3		3.3	3.5	13		2.7		23	2.8	3.9	
4		3.15	3.3	14		2.7		24	2.9	3.8	
5		3.0	3.2	15		3.0		25	3.0	3.55	
6		2.7		16		3.3		26	3.3	3.3	
7		2.6		17		3.6		27	3.5	3.15	
8		2.5		18		3.7		28	3.75	3.0	
9		2.45		19	3.0	3.7		29	3.9	3.0	
10		2.4		20		3.85		30	3.75	3.0	
								31	3.65	3.0	

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.							1907.						
1		3.7	3.75		3.25	3.3	16	2.8	3.2	2.8	3.3	3.1	3.2
2		5.0	3.75		3.25	3.3	17	2.8	3.1	2.8	3.7	3.0	3.1
3		4.3	3.65		3.1	3.4	18	2.8	3.6	2.8	3.2	3.0	3.2
4		4.0	3.65		3.1	3.3	19	2.8	3.5	2.7	3.1	3.0	3.2
5		4.35	3.7		3.25	3.3	20	2.9	3.5	2.6	3.2	3.05	3.1
6		4.15	3.8		3.25	3.4	21	3.1	4.1	2.6	3.1	3.15	3.1
7		4.1	3.7	4.1	3.25	3.4	22	3.1	4.35	2.6	3.1	3.05	3.15
8		4.0	3.7	3.7	3.1	3.4	23	3.15	4.1	3.3	3.1	2.9	3.2
9		3.8	3.65	3.5	3.15	3.4	24	3.3	4.25	3.3	3.2	2.9	3.0
10		3.7	3.5	3.0	3.1	3.4	25	3.45	4.15	3.35	3.2	3.0	3.1
11		3.6	3.4	2.8	3.1	3.4	26	4.3	4.0	3.35	3.1	3.2	3.3
12	3.3	3.5	3.2	2.7	3.1	3.35	27	4.35	3.8	3.3	3.1	3.25	3.1
13	3.2	3.5	3.1	2.8	3.05	3.3	28	4.3	3.8	3.2	3.1	3.3	3.1
14	3.0	3.2	2.95	2.7	3.05	3.4	29	3.95	3.8	3.15	3.25	3.3	3.1
15	2.9	3.2	2.9	3.5	3.05	3.2	30	3.85	3.8	3.1	3.25	3.3	3.2
							31	3.8	3.8		3.25		3.25

[a] These gage heights were omitted from Water-Supply Paper 212, p. 47, where are given gage heights for February to June, 1906.

Daily gage height, in feet, of Sevier River near Marysvale, Utah, for 1906 to 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	3.3	3.05	3.2	3.3	4.1	3.4	2.7	4.7	3.4	3.25	2.9	.....
2	3.2	3.1	3.0	3.25	4.3	3.4	2.8	5.15	3.45	3.2	2.9	.....
3	3.2	3.1	3.0	3.35	4.4	3.3	3.0	4.9	3.6	3.2	2.85	2.65
4	3.2	3.2	3.0	3.50	4.65	3.3	3.0	4.9	3.6	3.25	2.9	.....
5	3.25	3.15	3.0	3.45	4.6	3.25	2.95	4.4	3.8	3.3	2.85	.....
6	3.2	3.3	3.15	3.5	4.55	3.25	3.0	4.25	3.6	2.95	2.85	.....
7	3.1	3.2	3.0	3.6	4.5	3.45	2.9	4.0	3.5	2.8	2.85	.....
8	3.1	3.15	3.0	3.8	4.5	3.45	2.9	3.7	3.5	2.75	2.85	.....
9	3.15	3.3	2.95	3.8	4.55	3.3	2.9	3.45	4.4	2.7	2.8	.....
10	3.2	3.3	2.9	3.7	4.35	3.15	2.95	3.9	3.8	2.6	2.8	.....
11	3.2	3.35	2.9	3.7	4.15	3.1	2.9	5.1	3.8	2.55	2.8	.....
12	3.1	3.2	2.95	3.8	4.1	3.0	3.3	4.6	3.8	2.5	2.8	2.5
13	3.25	3.25	2.95	3.85	4.1	3.05	3.1	4.4	3.85	2.45	2.8	.....
14	3.15	3.1	3.05	4.3	4.0	3.1	3.35	4.1	3.85	2.45	2.8	.....
15	3.35	3.1	3.2	4.7	3.9	3.25	3.55	3.9	3.8	2.4	2.8	.....
16	3.35	3.2	3.35	4.9	3.7	3.2	3.6	3.65	3.75	2.5	2.8	.....
17	3.2	3.2	3.5	4.8	3.5	3.3	3.55	3.55	3.7	2.6	2.75	.....
18	3.1	3.25	3.55	4.8	3.45	3.25	3.5	3.55	3.6	2.7	2.7	.....
19	3.2	3.25	3.55	4.9	3.3	3.2	3.3	3.8	3.5	2.8	2.65	4.4
20	3.2	3.25	3.55	5.3	3.25	3.1	3.2	3.5	3.5	2.8	2.65	4.5
21	3.1	3.2	3.5	5.25	3.3	3.1	3.25	3.35	3.4	2.9	2.7	4.3
22	3.25	3.25	3.5	5.35	3.2	2.85	3.1	3.25	3.4	2.8	2.7	4.3
23	3.25	3.4	3.4	5.6	3.2	2.7	3.1	3.2	3.4	2.8	2.75	4.2
24	3.2	3.3	3.45	5.55	3.2	2.7	3.15	3.1	3.4	2.75	2.7	4.2
25	3.2	3.3	3.5	4.9	3.15	2.65	3.3	3.0	3.4	2.95	.....	4.2
26	3.25	3.35	3.4	4.65	3.15	2.5	3.65	2.95	3.6	3.0	.....	3.3
27	3.25	3.4	3.2	4.5	3.2	2.65	3.65	2.8	3.45	3.0	.....	3.3
28	3.2	3.2	3.45	4.35	3.25	2.3	3.7	2.7	3.6	2.95	.....	3.3
29	3.2	3.1	3.4	4.4	3.2	2.2	4.2	2.75	3.55	2.95	2.6	3.3
30	3.1	.....	3.35	4.2	3.1	2.4	4.9	3.25	3.45	2.9	2.55	3.1
31	3.1	.....	.....	.....	3.3	.....	4.7	3.3	.....	2.9	.....	3.2

NOTE.—Ice conditions December 18 to 31, 1908.

Rating table for Sevier River near Marysvale, Utah, for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	140	3.60	358	5.00	705	6.80	1,410
2.30	151	3.70	378	5.10	736	7.00	1,510
2.40	163	3.80	399	5.20	768	7.20	1,610
2.50	176	3.90	421	5.30	800	7.40	1,710
2.60	189	4.00	444	5.40	834	7.60	1,810
2.70	203	4.10	467	5.50	870	7.80	1,910
2.80	218	4.20	491	5.60	906	8.00	2,010
2.90	234	4.30	515	5.70	942	8.20	2,110
3.00	250	4.40	540	5.80	980	8.40	2,210
3.10	267	4.50	565	5.90	1,020	8.60	2,310
3.20	284	4.60	591	6.00	1,060	8.80	2,410
3.30	302	4.70	618	6.20	1,142		
3.40	320	4.80	646	6.40	1,226		
3.50	339	4.90	675	6.60	1,316		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1906 to 1908, and is fairly well defined between gage heights 2.2 feet and 6.5 feet. Above gage height 6.8 feet the rating curve is a tangent, the difference being 50 per tenth.

Monthly discharge of Sevier River near Marysvale, Utah, for 1906 to 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.[a]					
February 18-28	208	176	190	4,150	B.
March	258	153	187	11,500	B.
April	736	182	362	21,500	B.
May	2,300	618	1,470	90,400	C.
June	1,640	330	895	53,300	B.
July 19-31	421	218	297	7,660	B.
August	479	163	287	17,600	B.
September 1-5	444	250	324	3,210	B.
The period				209,000	
1907.					
July 12-31	528	218	321	12,700	B.
August	705	267	413	25,400	B.
September	399	189	296	17,600	B.
October	467	203	307	18,900	B.
November	302	234	271	16,100	B.
December	320	250	293	18,000	B.
The period				109,000	
1908.					
January	311	267	284	17,500	B.
February	320	258	289	16,600	B.
March	348	234	291	17,900	B.
April	906	293	534	31,800	B.
May	604	267	406	25,000	B.
June	330	140	258	15,400	B.
July	675	203	315	19,400	B.
August	752	203	412	25,300	B.
September	540	320	363	21,600	B.
October	302	163	224	13,800	B.
November	234	182	212	12,600	B.
December			178	10,900	C.
The year	906	140	314	228,000	

[a] Discharge interpolated February 19 and 20, and May 10 to 22.

NOTE.—Ice conditions December 18 to 31, 1908, and discharge estimated. Discharge interpolated on days when gage was not read.

SEVIER RIVER NEAR GUNNISON, UTAH.

This station, which was established June 29, 1900, to obtain data for use in connection with irrigation in the Sevier Valley, is located about 4 miles west of Gunnison, Utah, on the road to Westview precinct. It is about three-fourths of a mile above the mouth of San Pitch River and below all other tributaries of importance.

The river freezes occasionally during the winter and the channel is liable to shift slightly during floods, but on the whole the records obtained are good.

Discharge measurements of Sevier River near Gunnison, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 2	G. T. Burridge	78	369	5.35	1,430
July 13	do	50	181	2.50	307
July 31	do	51	188	2.40	309
August 25	La Rue and Burridge	60	245	3.45	709
1908.					
April 15	A. D. Williams	39	137	2.00	173
June 6	do	38	161	1.80	163
June 6	do	42	145	1.80	157
June 25	do	42	135	1.70	132

Daily gage height, in feet, of Sevier River near Gunnison, Utah, for 1907 and 1908.

[L. H. Erickson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.8	2.85	2.8	3.0	3.75	5.6	4.1	.....	3.0	1.95	2.8	2.8
2	2.8	2.9	2.8	2.95	3.45	5.65	4.05	2.45	2.85	1.9	2.8	2.8
3	2.85	2.9	2.8	2.9	3.4	5.7	4.0	2.7	2.8	2.35	2.8	2.8
4	2.85	2.9	2.8	2.8	3.4	5.75	3.85	2.95	2.8	2.35	2.8	2.8
5	2.85	2.85	2.85	2.75	3.35	5.8	3.5	.....	2.8	2.3	2.8	2.8
6	2.9	2.85	2.85	2.7	3.3	5.85	3.35	2.95	2.75	2.3	2.8	2.85
7	2.85	2.9	2.85	.....	3.4	5.9	3.3	3.2	2.75	2.35	2.8	2.9
8	2.85	2.95	2.9	2.55	3.45	6.0	3.2	3.55	2.7	2.35	2.8	3.0
9	2.85	2.95	2.9	2.6	3.5	6.0	3.1	3.6	2.7	2.35	2.8	3.0
10	2.9	2.95	2.9	2.7	3.45	6.05	3.05	3.6	2.7	2.3	2.85	3.0
11	2.9	2.8	2.9	2.75	3.7	6.1	3.0	3.15	2.7	2.3	2.85	3.05
12	2.9	2.8	2.9	2.8	4.2	6.1	2.8	3.1	2.65	.....	2.9	3.1
13	2.9	2.8	2.85	2.85	4.55	6.1	2.7	3.1	2.6	.....	.....	3.1
14	2.9	2.7	2.8	2.9	4.55	6.1	2.75	2.95	2.6	2.4	2.8	3.2
15	2.9	2.7	2.8	2.95	4.55	6.0	2.7	2.85	2.6	2.45	2.8	3.2
16	2.95	2.6	2.8	3.0	4.7	5.85	2.55	2.8	2.55	2.5	2.8	3.2
17	3.0	2.6	2.75	.....	4.9	5.85	2.3	2.8	2.55	2.5	2.85	3.2
18	3.2	2.6	2.7	3.0	5.0	5.6	2.0	2.85	2.55	2.55	2.85	3.2
19	3.7	2.6	2.7	3.4	5.1	5.45	1.95	2.8	2.5	2.6	2.8	3.25
20	3.3	2.65	2.7	4.05	5.1	5.3	1.75	2.8	2.5	2.6	2.8	3.25
21	3.1	2.6	2.65	4.15	5.1	5.25	1.7	2.8	2.5	2.6	2.8	3.3
22	3.0	2.65	2.65	4.25	5.0	5.2	1.7	2.75	2.45	2.65	.....	3.3
23	3.0	2.65	2.7	4.35	5.15	5.05	1.7	3.0	2.4	2.65	.....	3.3
24	2.85	2.65	2.8	4.45	5.15	5.0	1.65	3.05	2.3	2.7	2.8	3.3
25	2.85	2.6	2.8	4.4	5.1	4.85	1.65	3.3	2.25	2.7	2.8	3.3
26	2.8	2.6	2.8	4.2	5.1	4.5	1.7	3.25	2.2	2.7	2.8	3.3
27	2.8	2.65	2.85	4.15	5.3	5.35	2.1	3.2	2.2	2.8	2.8	3.25
28	2.8	2.8	2.8	4.0	5.45	4.25	2.0	3.1	2.15	2.8	2.85	3.3
29	2.8	.....	2.9	3.75	5.5	4.2	1.95	3.0	1.95	.....	2.8	3.3
30	2.85	.....	2.9	3.7	5.5	4.1	2.0	3.0	1.95	.....	2.8	3.3
31	2.8	.....	3.0	.....	5.55	.....	2.45	3.0	.....	2.8	.....	3.3
1908.												
1	3.3	3.0	3.0	.....	.....	.....	.....	.....	1.95	2.6	3.0	2.7
2	3.3	.....	3.0	.....	2.75	1.9	.....	.....	.....	2.6	.....	2.65
3	3.3	3.0	2.9	2.75	.....	.....	1.7	3.55	2.0	2.65	2.95	2.65
4	3.15	3.0	2.9	.....	2.7	1.95	1.75	.....	.....	2.75	2.95	.....
5	3.15	3.0	.....	2.7	.....	2.1	.....	.....	2.0	2.75	.....	2.7
6	3.1	3.0	.....	2.7	.....	.....	1.75	3.65	.....	2.65	2.9	.....
7	3.1	3.0	2.9	.....	2.7	2.15	.....	3.7	2.0	2.65	.....	2.7
8	3.1	3.0	.....	2.55	.....	.....	1.65	3.7	.....	2.6	2.9	2.7
9	3.15	.....	.....	.....	.....	2.3	.....	.....	2.05	2.5	2.9	.....
10	3.15	3.0	2.9	.....	.....	.....	1.25	3.55	.....	2.5	2.85	2.65
11	3.2	3.0	.....	2.35	2.6	2.35	1.1	.....	2.1	2.5	.....	2.6
12	3.2	3.0	.....	.....	3.0	2.35	.....	3.45	.....	2.55	2.85	.....
13	3.2	3.0	.....	2.1	.....	.....	1.35	.....	2.1	.....	.....	2.7
14	3.2	3.0	2.85	.....	3.15	2.5	.....	.....	2.1	2.6	2.9	.....
15	3.15	3.0	2.8	.....	.....	.....	1.4	3.25	.....	2.65	.....	2.75
16	3.15	3.0	.....	.....	2.8	2.75	.....	.....	2.1	2.65	2.9	.....
17	3.1	3.0	2.8	1.95	2.8	2.65	1.35	3.2	2.2	2.7	2.9	2.75
18	3.1	3.05	.....	.....	.....	.....	1.4	.....	.....	.....	.....	2.75
19	3.1	3.05	.....	2.3	2.75	2.6	.....	3.5	2.2	2.7	2.85	.....
20	3.05	3.05	2.8	.....	.....	.....	1.45	.....	.....	.....	.....	.....
21	3.05	3.05	.....	.....	2.7	1.95	.....	3.3	2.2	2.7	2.85	.....
22	3.1	3.1	2.75	2.7	.....	.....	1.5	.....	.....	.....	.....	.....
23	3.1	3.1	.....	.....	2.7	.....	.....	3.2	2.25	2.9	2.85	.....
24	3.05	3.1	.....	2.9	.....	1.75	2.0	.....	.....	.....	2.85	.....
25	3.1	3.1	2.75	.....	2.6	.....	1.85	3.2	2.4	2.9	.....	.....
26	3.05	3.0	.....	2.85	.....	1.75	.....	.....	.....	2.9	2.85	.....
27	3.05	3.0	2.75	.....	.....	.....	1.55	.....	2.2	.....	.....	.....
28	3.05	.....	.....	3.0	2.0	.....	.....	2.2	2.25	2.9	2.85	.....
29	3.0	.....	2.75	3.1	.....	1.7	1.75	.....	2.3	2.9	.....	.....
30	3.0	.....	.....	2.95	1.95	1.7	.....	1.95	2.45	3.0	2.8	.....
31	3.0	.....	.....	.....	.....	.....	.....	.....	.....	3.0	.....	.....

NOTE.—There was some ice in the latter part of December, 1907, but the gage heights were probably not materially affected. Ice conditions December 19 to 31, 1908.

Rating table for Sevier River near Gunnison, Utah, for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*
0.90	37	2.00	202	3.10	495	4.40	1,013
1.00	47	2.10	223	3.20	527	4.60	1,115
1.10	57	2.20	245	3.30	559	4.80	1,223
1.20	68	2.30	269	3.40	593	5.00	1,335
1.30	80	2.40	294	3.50	627	5.20	1,459
1.40	94	2.50	320	3.60	663	5.40	1,592
1.50	109	2.60	348	3.70	701	5.60	1,728
1.60	125	2.70	377	3.80	741	5.80	1,864
1.70	143	2.80	406	3.90	783	6.00	2,000
1.80	162	2.90	435	4.00	825	6.20	2,140
1.90	182	3.00	465	4.20	915	6.40	2,280

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1906–1908, and is fairly well defined below gage height 2.6 feet.

Monthly discharge of Sevier River near Gunnison, Utah, for 1906 to 1908.

[Drainage area, 3,990 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.[a]							
January	701	150	390	0.098	0.11	24,000	C.
February	435	202	308	.077	.08	17,100	B.
March	441	103	286	.072	.08	17,600	B.
April	634	377	520	.130	.14	30,900	C.
May	2,240	627	1,370	.343	.40	84,200	C.
June	1,800	435	1,080	.271	.30	64,300	C.
July	294	42	130	.033	.04	7,990	B.
August	495	132	213	.053	.06	13,100	B.
September	354	182	271	.068	.08	16,100	B.
October	406	202	265	.066	.08	16,300	B.
November	365	269	298	.075	.08	17,700	B.
December	435	383	413	.104	.12	25,400	B.
The year	2,240	42	462	.116	1.57	335,000	
1907.							
January	701	406	445	.112	.13	27,400	B.
February	450	348	392	.098	.10	21,800	B.
March	465	362	410	.103	.12	25,200	B.
April	1,040	334	593	.149	.17	35,300	C.
May	1,690	559	1,100	.276	.32	67,600	C.
June	2,070	869	1,650	.414	.46	98,200	C.
July	869	134	377	.095	.11	23,200	B.
August	663	307	468	.117	.13	28,800	B.
September	465	192	333	.083	.09	19,800	B.
October	406	182	320	.080	.09	19,700	B.
November	435	406	410	.103	.11	24,400	B.
December	559	406	503	.126	.15	30,900	C.
The year	2,070	134	583	.146	1.98	422,000	
1908.							
January	559	465	503	.126	.15	30,900	C.
February	495	465	471	.118	.13	27,100	C.
March	465	392	416	.104	.12	25,600	B.
April	495	192	342	.086	.10	20,400	B.
May	511	192	363	.091	.10	22,300	B.
June	392	143	233	.058	.06	13,900	B.
July	362	57	136	.034	.04	8,360	B.
August	701	192	520	.130	.15	32,000	C.
September	307	192	234	.059	.07	13,900	B.
October	465	320	384	.096	.11	23,600	B.
November	465	406	430	.108	.12	25,600	B.
December	.....	.....	365	.091	.10	22,400	C.
The year	701	57	366	.092	1.26	266,000	

[a] Gage heights for 1906 are given in Water-Supply Paper 212, p. 46. Those for July 1 to 11 are 1.4 too high.

NOTE.—Discharges estimated on account of ice conditions, January 1 to 19, 1906, and December 19 to 31, 1908; the open-channel rating was applied the rest of the three years, though there may have been some ice. Discharges interpolated on days when gage was not read.

HUMBOLDT SINK DRAINAGE BASIN.

HUMBOLDT RIVER.

DESCRIPTION.

Humboldt River rises in the northeastern part of Nevada and flows west and southwest a distance of about 350 miles into Humboldt Lake or Sink, in the western part of the State. The entire basin is surrounded by high and rugged peaks, some of which attain elevations of 11,000 feet above sea. A dam built a few years ago prevents the overflow in flood season from reaching Carson Sink, about 30 miles to the west.

The river is anomalous among the streams of the Great Basin in that both its source and its terminus are well within the area of interior drainage. Its valley is narrow, and its course and that of its tributaries is in general through a barren region destitute of large trees and supporting few shrubs except scattered clusters of willows. Affording the only east and west pass through the mountains of Nevada, the valley of the main stream is followed by the Southern Pacific Railroad.

During the early spring and summer months the run-off of the North and South forks is very heavy because of the melting of the snows at the headwaters; as soon as the snow is all gone the rivers are left without a source of supply and their channels gradually become dry.

Several tributaries find their way into the main river, Rock Creek and Reese River entering near Battle Mountain, the North and South forks near Elko, and the Little Humboldt near Winnemucca.

Although the opportunities for reclamation are many, the cost of the necessary work would be very great, owing to the engineering difficulties to be overcome. The basin affords several reservoir sites where the flood waters could be collected and stored for use during the summer months.

Lovelock Valley is considered the most fertile valley in the basin, and the entire flow of the river is appropriated for irrigation.

Alfalfa and grass hay are the chief crops; the land is best adapted for grazing.

The availability of the stream for power development is small, owing to the slight fall. Possibly the best stream for this purpose is the South Fork.

Within the period for which records are available the wettest year was 1907 and the driest year 1905.

The following stations have been maintained in this basin:

Humboldt River near Elko, Nev., 1895–1902.
Humboldt River at Palisade, Nev., 1902–1906.
Humboldt River at Battle Mountain, Nev., 1896–1897.
Humboldt River near Golconda, Nev., 1894–1908.

Humboldt River near Oreana, Nev., 1896–1908.
Marys River near Deeth, Nev., 1902–1903.
North Fork of Humboldt River near Peko, Nev., 1898–1900.
North Fork of Humboldt River near Halleck, Nev., 1902–1908.
South Fork of Humboldt River near Elko, Nev., 1896–1908.
Pine Creek near Palisade, Nev., 1902–1904.
Rock Creek near Battle Mountain, Nev., 1896.

HUMBOLDT RIVER NEAR GOLCONDA, NEV.

This station, which was established October 24, 1894, to determine the quantity of water available for irrigation in the vicinity of Golconda and Winnemucca, is located 1¼ miles north of the town of Golconda.

The station is below the central valley, below Reese River and Rock and Keely creeks, and above all other important tributaries except Little Humboldt River, which enters about 12 miles below. Considerable water is diverted above the station, almost the entire low-water flow being used for irrigation.

The records are believed not to be materially affected by ice, but information as to winter conditions is meager.

Two gages have been used at this station, the difference in datum being 0.1 foot, and the observers' records do not always specify which gage was used. As the channel is somewhat shifting, the records are not of the best, but the station is nevertheless probably the most reliable on the Humboldt.

Discharge measurements of Humboldt River near Golconda, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 16	Nicholas and Porter	93	558	11.90	1,350
June 25	E. A. Porter	94	651	13.00	1,760
July 29	do	91	479	10.90	1,050
August 20	do	.....	196	7.90	350
1908.					
March 5	E. A. Porter	56	190	7.10	373
April 9	do	56	179	6.50	309
July 18	do	79	260	7.65	522

NOTE.—Gage heights for 1907 were read from the gage at the wagon bridge. This gage was washed away in December. The gage used in 1908 was the old gage on the left bank, which read 0.1 foot higher than the gage at the bridge.

Daily gage height, in feet, of Humboldt River near Golconda, Nev., for 1907 and 1908.

[W. Duyck, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1					16.6	11.4	13.2			6.0	6.9	7.5
2	5.2	7.1	10.5						7.2	6.0	7.0	7.5
3				16.0		11.3	13.6	10.4		6.0	7.1	7.5
4		7.5	10.4		15.2				7.0	6.0	7.1	7.5
5	5.5			16.0		11.6		10.2		6.0	7.1	7.5
6		8.6	10.3	16.0	14.0		14.0			6.0	7.1	7.5
7	5.4							10.0	6.8	6.0	7.1	7.6
8				16.6	13.6	11.6	13.6			6.0	7.1	7.6
9	5.4	8.0	10.2						6.7	6.1	7.1	7.6
10		8.5		16.6		11.8	13.6	9.5		6.1	7.1	7.6
11			10.3		13.2				6.6	6.1	7.1	7.6
12	5.3					12.0		9.1		6.2	7.1	7.6
13		9.2	10.4	16.6	13.0		13.6			6.2	7.2	7.6
14	5.3				13.0			9.0	6.4	6.2	7.2	7.7
15			10.5	16.6	12.9	12.0	13.4			6.2	7.2	7.8
16	5.3	10.0			11.9	12.0			6.2	6.2	7.2	7.8
17		10.0		16.6		12.0	13.3	8.4		6.2	7.2	7.8
18		10.0	10.5		11.8				6.0	6.2	7.3	7.8
19	5.4					12.6		8.0		6.2	7.3	7.8
20		10.0	10.9	16.6	11.7		13.4	7.9		6.3	7.3	7.8
21	5.4		11.0			13.0		7.8	6.0	6.4	7.3	7.9
22			11.3	16.6	11.4	13.0	13.3			6.4	7.3	8.0
23	5.4	10.1	11.5						6.0	6.5	7.3	8.0
24				16.6		13.0	12.6	7.6		6.5	7.4	8.0
25		10.2	11.5		11.4				6.0	6.5	7.4	8.0
26	5.5		12.4			13.1		7.6		6.6	7.4	8.0
27		10.3	13.2	16.6	11.4		11.6			6.8	7.4	8.0
28	5.8							7.5	6.0	6.8	7.4	8.0
29				16.6	11.4	13.3	11.0			6.8	7.4	7.9
30	6.0		14.6						6.0	6.9	7.5	8.0
31			15.2				10.8	7.4		6.9		8.0
1908.												
1			6.5	6.0	6.5	7.0	8.5	6.1	3.3	2.9	2.9	4.5
2	8.3	6.4		6.0	6.6	7.0	9.0	6.0	3.3	3.1	2.9	4.7
3			6.6	6.0	6.6	7.0	9.0		3.3	3.2	2.9	4.9
4		6.3		6.0	6.7	7.1	9.0	5.8	3.2	3.1	2.9	5.0
5	7.9		7.1	6.0	6.5	7.1	8.6		3.2	3.1	2.9	5.15
6				6.0	6.5	7.0	8.4	5.5	3.2	3.1	2.9	5.3
7		6.3	7.4	6.0	6.6	7.0	8.4		3.3	3.1	2.8	5.5
8	7.1			6.2	5.7	7.0		5.0	3.3	3.0	2.8	5.6
9		6.4		6.5	5.7	6.7			3.3	3.0	2.8	5.7
10			7.6	6.4	5.7	6.8		4.8	3.3	2.9	2.9	5.8
11	6.2			6.4	6.0	6.8		4.6	3.3	2.9	2.9	5.9
12		6.5		6.7	6.0	6.7			3.3	2.9	3.0	6.0
13			7.5	6.1	5.8	6.7		4.0	3.3	2.9	3.1	5.9
14	6.3			6.2	6.0	6.7			3.3	2.9	3.2	5.7
15		6.5		6.25	5.6	6.7		4.0	3.3	3.0	3.2	5.6
16	6.3		7.3	6.35	5.6	6.7		4.0	3.2	3.0	3.2	5.5
17		6.6	7.3	6.25	5.0	6.7		4.0	3.1	3.0	3.2	5.4
18	6.4			6.35	4.6	7.5	7.65	4.0	3.1	3.0	3.2	5.3
19				6.3	4.6	7.5		4.0	3.1	3.1	3.2	5.1
20		6.5	7.3	6.5	4.6	7.5		4.0	3.1	3.1	3.2	5.0
21	6.4			6.7	6.6	7.5		4.0	3.1	3.0	3.3	5.0
22		6.5			5.9	7.5		3.8	3.0	3.0	3.3	5.0
23	6.4		7.2	6.6	5.6	8.5		4.0	3.0	3.0	3.5	5.0
24				6.6	6.8	8.5	7.1	3.8	3.0	3.0	3.6	5.0
25	6.5	6.4		6.6	7.0	8.5	7.1	3.6	2.9	3.0	3.75	5.0
26			7.2		7.0	8.5	7.0	3.5	2.9	3.0	3.75	5.0
27		6.4		6.5	7.0	8.5	6.8	3.3	2.9	3.0	3.8	5.0
28	6.6			6.5	7.0	8.5	6.6	3.3	2.9	3.05	3.95	5.0
29		6.5	7.1	6.2	7.0	8.5	6.5	3.3	2.9	3.1	4.1	5.0
30				6.5	7.0	8.5	6.4	3.3	2.9	3.1	4.3	5.0
31	6.4		6.0		7.0		6.2	3.3		3.2		5.0

NOTE.—The river was frozen December 16 to 31, 1908; there was a little ice in the first half of the month; the effect on the discharge was probably very slight. The 1908 gage heights refer to a datum 0.1 foot lower than those of 1907.

Rating tables for Humboldt River near Golconda, Nev.

JANUARY 1, 1907, TO MARCH 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.20	120	6.70	300	8.20	590	10.40	1,240
5.30	130	6.80	315	8.30	615	10.60	1,310
5.40	140	6.90	330	8.40	640	10.80	1,380
5.50	150	7.00	345	8.50	665	11.00	1,450
5.60	160	7.10	360	8.60	690	11.20	1,520
5.70	171	7.20	380	8.70	715	11.40	1,590
5.80	182	7.30	400	8.80	740	11.60	1,660
5.90	194	7.40	420	8.90	770	11.80	1,730
6.00	206	7.50	440	9.00	800	12.00	1,800
6.10	218	7.60	460	9.20	860	13.00	2,160
6.20	231	7.70	480	9.40	920	14.00	2,560
6.30	244	7.80	500	9.60	980	15.00	2,960
6.40	258	7.90	520	9.80	1,040	16.00	3,360
6.50	272	8.00	540	10.00	1,100		
6.60	286	8.10	565	10.20	1,170		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906, and is fairly well defined above gage height 5.0 feet.

APRIL 1, 1907, TO DECEMBER 31, 1907.

6.00	100	7.30	252	8.60	487	10.80	1,020
6.10	109	7.40	267	8.70	507	11.00	1,080
6.20	119	7.50	283	8.80	528	11.20	1,140
6.30	129	7.60	299	8.90	549	11.40	1,202
6.40	139	7.70	316	9.00	570	11.60	1,266
6.50	150	7.80	333	9.20	614	11.80	1,332
6.60	161	7.90	351	9.40	659	12.00	1,400
6.70	173	8.00	370	9.60	705	13.00	1,750
6.80	185	8.10	389	9.80	752	14.00	2,120
6.90	197	8.20	408	10.00	800	15.00	2,520
7.00	210	8.30	427	10.20	852	16.00	2,920
7.10	223	8.40	447	10.40	906	17.00	3,320
7.20	237	8.50	467	10.60	962		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907, and is fairly well defined between gage heights 7.9 feet and 13.0 feet.

JANUARY 1, 1908, TO MARCH 20, 1908.

6.20	236	6.80	323	7.40	428	8.00	549
6.30	250	6.90	339	7.50	447	8.10	571
6.40	264	7.00	356	7.60	467	8.20	593
6.50	278	7.10	373	7.70	487	8.30	615
6.60	292	7.20	391	7.80	507		
6.70	307	7.30	409	7.90	527		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908 and the form of the 1906 curve, from which it differs only slightly. It is fairly well defined. The change in conditions between the last measurement of 1907 and the first of 1908 may have taken place gradually, but in the absence of definite information it has been assumed to occur on January 1, which was the highest water of the period.

MARCH 21, 1908, TO DECEMBER 31, 1908.

2.80	1.5	4.00	46	5.20	146	6.80	358
2.90	2.5	4.10	52	5.30	156	7.00	390
3.00	4	4.20	59	5.40	166	7.20	426
3.10	6	4.30	66	5.50	178	7.40	466
3.20	9	4.40	74	5.60	190	7.60	508
3.30	12	4.50	82	5.70	202	7.80	554
3.40	16	4.60	90	5.80	214	8.00	606
3.50	20	4.70	98	5.90	226	8.20	658
3.60	24	4.80	107	6.00	240	8.40	710
3.70	29	4.90	116	6.20	268	8.60	766
3.80	34	5.00	126	6.40	296	8.80	822
3.90	40	5.10	136	6.60	326	9.00	880

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1908 and the form of previous curves, and is fairly well defined above gage height 6.0 feet. Below gage height 5.0 feet it is only approximate.

Monthly discharge of Humboldt River near Golconda, Nev., for 1907 and 1908.

[Drainage area, 10,800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	272	120	147	0.014	0.02	9,040	C.
February	1,200	315	864	.080	.08	48,000	B.
March	3,040	1,170	1,540	.143	.16	94,700	B.
April	3,160	2,920	3,110	.288	.32	185,000	B.
May	3,160	1,200	1,690	.156	.18	104,000	B.
June	1,860	1,170	1,500	.139	.16	89,300	B.
July	2,120	1,020	1,750	.162	.19	108,000	B.
August	962	267	533	.049	.06	32,800	B.
September	252	100	143	.013	.01	8,510	C.
October	197	100	131	.012	.01	8,060	C.
November	283	197	241	.022	.02	14,300	C.
December	370	283	327	.030	.03	20,100	C.
The year	3,160	100	998	.094	1.24	722,000	
1908.							
January	615	236	331	.031	.04	20,400	C.
February	292	250	269	.025	.03	15,500	C.
March	467	240	402	.037	.04	24,700	B.
April	342	240	286	.026	.03	17,000	B.
May	390	90	271	.025	.03	16,700	C.
June	738	342	487	.045	.05	29,000	B.
July	880	268	557	.052	.06	34,200	C.
August	254	12	83.7	.0078	.009	5,150	D.
September	12	2.5	7.90	.00073	.0008	470	D.
October	9	2.5	4.65	.00043	.0005	286	D.
November	66	1.5	14.2	.0013	.001	845	D.
December	240	82	153	.014	.02	9,410	D.
The year	880	1.5	239	.022	.31	174,000	

NOTE.—Discharges interpolated for days when gage was not read.

HUMBOLDT RIVER NEAR OREANA, NEV.

This station, which was established January 27, 1896, to determine the amount of water available for storage-reservoir sites in the vicinity of Humboldt station and also for the six canal systems now in operation below Oreana, is located near Oreana, Nev., about 12 miles northeast of Lovelock and below all tributaries.

The channel is very unstable and sufficient measurements have not been made to give results that are entirely satisfactory or reliable.

Discharge measurements of Humboldt River near Oreana, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 18	E. A. Porter	114	620	7.40	1,610
June 24	do	108	423	6.90	988
July 22	do	111	537	7.70	1,360
August 19	do	103	216	4.70	476
1908.					
March 14	E. A. Porter	105	207	4.10	388
May 10	do	81	53	2.30	70

Daily gage height, in feet, of Humboldt River near Oreana, Nev., for 1907 and 1908.

[J. J. McCarthy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.5	3.45	4.85	6.4	8.6	6.7	7.95	7.15	4.05	3.05	3.0	3.3
2	2.65	3.55	4.9	6.45	8.7	6.65	7.95	7.1	4.0	3.0	3.0	3.3
3	2.7	4.0	5.05	6.45	8.7	6.5	8.0	7.05	3.9	3.0	3.0	3.35
4	2.8	4.0	5.1	6.5	8.75	6.5	8.2	6.1	3.85	3.05	3.0	3.35
5	2.8	3.9	5.1	6.85	8.75	6.5	8.3	6.1	3.7	3.0	3.05	3.4
6	2.85	3.85	5.15	6.9	8.7	6.5	8.35	6.5	3.7	3.0	3.05	3.45
7	2.85	3.7	5.15	6.95	8.65	6.45	8.4	5.7	3.65	3.0	3.1	3.5
8	2.8	3.6	5.2	6.95	8.6	6.4	8.4	5.6	3.5	2.95	3.1	3.5
9	2.8	3.55	5.25	7.0	8.5	6.45	8.45	5.55	3.45	3.0	3.05	3.5
10	2.85	3.6	5.25	7.0	8.05	6.45	8.5	5.5	3.45	3.0	3.05	3.4
11	2.95	3.6	5.25	7.1	7.95	6.4	8.55	5.45	3.4	3.0	3.05	3.45
12	2.95	3.65	5.25	7.35	7.8	6.4	8.55	5.3	3.45	3.0	3.15	3.45
13	2.95	3.7	5.3	7.4	7.8	6.45	8.5	5.2	3.45	2.95	3.1	3.5
14	2.95	3.75	5.3	7.65	7.75	6.55	8.3	5.15	3.3	2.95	3.1	3.4
15	2.95	3.8	5.3	7.9	7.7	6.55	8.25	5.05	3.3	3.0	3.15	3.5
16	3.05	3.95	5.35	8.0	7.65	6.6	8.15	4.9	3.3	3.0	3.15	3.5
17	3.1	4.15	5.35	8.1	7.5	6.6	8.5	4.8	3.25	3.0	3.2	3.4
18	3.1	4.25	5.35	8.4	7.4	6.65	7.9	4.75	3.25	3.0	3.2	3.4
19	3.1	4.4	5.4	8.6	7.35	6.65	7.85	4.7	3.25	3.0	3.15	3.35
20	3.15	4.55	5.4	8.65	7.3	6.7	7.85	4.55	3.2	3.0	3.15	3.35
21	3.15	4.6	5.55	8.7	6.4	6.75	7.8	4.55	3.2	3.0	3.2	3.3
22	3.15	4.65	5.55	8.6	6.4	6.75	7.75	4.5	3.2	3.0	3.25	3.5
23	3.2	4.7	5.6	8.55	6.35	6.8	7.75	4.45	3.15	3.05	3.25	3.45
24	3.2	4.7	5.7	8.5	6.35	6.9	7.7	4.4	3.15	3.05	3.25	3.4
25	3.2	4.75	5.75	8.45	6.3	7.5	7.6	4.3	3.15	3.05	3.2	3.4
26	3.2	4.75	5.8	8.4	6.5	7.15	7.55	4.25	3.1	3.1	3.2	3.45
27	3.25	4.8	5.9	8.4	6.65	7.25	7.55	4.2	3.05	3.1	3.25	3.45
28	3.25	4.85	5.95	8.45	6.65	7.4	7.5	4.2	3.05	3.15	3.25	3.5
29	3.3	.....	6.1	8.5	6.65	7.45	7.4	4.15	3.05	3.1	3.3	3.45
30	3.3	.....	6.2	8.55	6.65	7.5	7.35	4.05	3.05	3.05	3.3	3.45
31	3.35	.....	6.25	.....	6.7	.....	7.25	3.95	.....	3.05	.....	3.4
1908.												
1	3.45	3.75	3.65	3.95	2.3	2.05	1.8	3.6	2.35	2.1	2.05	2.35
2	3.5	3.75	3.65	3.95	2.3	2.05	1.8	3.55	2.25	2.1	2.05	2.4
3	3.55	3.7	3.7	3.9	2.35	2.0	1.85	3.5	2.25	2.1	2.1	2.45
4	3.6	3.7	3.75	3.9	2.35	2.0	1.85	3.5	2.25	2.05	2.1	2.5
5	3.55	3.75	3.7	3.8	2.3	2.0	1.85	3.45	2.25	2.05	2.1	2.5
6	3.5	3.8	3.8	3.75	2.3	2.0	1.9	3.4	2.2	2.1	2.1	2.55
7	3.6	3.85	3.8	3.5	2.3	2.0	3.1	3.35	2.35	2.1	2.1	2.6
8	3.55	3.7	3.85	3.3	2.3	2.05	3.3	3.3	2.3	2.1	2.15	2.8
9	3.5	3.7	3.85	3.0	2.3	2.0	3.4	3.2	2.25	2.1	2.15	2.85
10	3.55	3.7	3.85	3.0	2.3	2.0	3.45	3.25	2.2	2.1	2.15	2.9
11	3.5	3.75	3.9	3.1	2.25	2.0	3.5	3.15	2.2	2.05	2.2	3.0
12	3.5	3.8	3.9	3.0	2.25	1.95	4.15	3.1	2.2	2.05	2.2	3.0
13	3.5	3.8	3.95	3.0	2.25	1.9	4.35	2.95	2.2	2.05	2.2	2.95
14	3.55	3.8	4.1	3.0	2.2	1.9	4.5	2.9	2.2	2.1	2.2	2.95
15	3.55	3.75	4.1	2.95	2.2	1.9	4.7	2.85	2.2	2.1	2.2	3.0
16	3.55	3.75	4.0	2.95	2.15	1.9	4.5	2.8	2.25	2.05	2.2	3.0
17	3.65	3.75	4.0	2.9	2.2	1.95	4.3	2.8	2.3	2.05	2.2	3.0
18	3.65	3.7	3.95	2.85	2.2	1.95	4.35	2.8	2.35	2.1	2.2	3.0
19	3.7	3.7	3.95	2.8	2.25	1.95	4.25	2.75	2.3	2.1	2.25	2.95
20	3.7	3.75	3.9	2.75	2.25	1.9	4.15	2.75	2.25	2.1	2.25	2.95
21	3.7	3.7	3.9	2.75	2.25	1.9	4.15	2.7	2.25	2.05	2.25	3.0
22	3.65	3.7	3.85	2.7	2.2	1.9	4.1	2.7	2.2	2.05	2.25	3.0
23	3.65	3.7	3.8	2.7	2.15	1.95	4.1	2.65	2.15	2.1	2.25	3.0
24	3.7	3.7	3.85	2.65	2.15	1.95	4.05	2.6	2.1	2.1	2.3	3.05
25	3.7	3.65	3.9	2.6	2.15	1.9	4.0	2.55	2.1	2.1	2.3	3.0
26	3.7	3.65	3.95	2.55	2.1	1.9	4.35	2.5	2.1	2.05	2.3	3.1
27	3.65	3.65	3.95	2.5	2.1	1.95	4.4	2.4	2.1	2.05	2.3	3.1
28	3.65	3.6	4.0	2.4	2.1	1.9	4.3	2.4	2.05	2.05	2.3	3.05
29	3.7	3.6	4.0	2.4	2.0	1.85	4.25	2.35	2.05	2.1	2.35	3.1
30	3.75	.....	3.95	2.35	2.0	1.8	4.0	2.35	2.05	2.1	2.35	3.1
31	3.75	.....	3.95	.....	2.05	.....	3.6	2.35	.....	2.05	.....	3.05

NOTE.—The river was blocked with ice January 29 to February 7, and December 8 to 31, 1908, and perhaps at other times.

Rating tables for Humboldt River near Oreana, Nev.

JANUARY 1 TO MAY 17, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	75	3.80	345	5.10	715	6.80	1,350
2.60	90	3.90	370	5.20	750	7.00	1,430
2.70	106	4.00	395	5.30	785	7.20	1,515
2.80	124	4.10	420	5.40	820	7.40	1,605
2.90	143	4.20	445	5.50	855	7.60	1,695
3.00	163	4.30	470	5.60	890	7.80	1,785
3.10	183	4.40	500	5.70	925	8.00	1,875
3.20	204	4.50	530	5.80	960	8.20	1,965
3.30	226	4.60	560	5.90	995	8.40	2,055
3.40	249	4.70	590	6.00	1,030	8.60	2,145
3.50	272	4.80	620	6.20	1,110	8.80	2,240
3.60	296	4.90	650	6.40	1,190		
3.70	320	5.00	680	6.60	1,270		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the 1905 curve, and is well defined above gage height 3.0 feet. Below gage height 3.0 feet it is merely a rough approximation.

MAY 18, 1907, TO MAY 4, 1908.

[Daily discharges were obtained by the indirect method for shifting channels.]

MAY 5, 1908, TO DECEMBER 31, 1908.

1.80	16	2.60	124	3.40	295	4.20	520
1.90	23	2.70	144	3.50	320	4.30	550
2.00	32	2.80	164	3.60	345	4.40	580
2.10	43	2.90	184	3.70	370	4.50	610
2.20	56	3.00	204	3.80	400	4.60	640
2.30	70	3.10	226	3.90	430	4.70	670
2.40	86	3.20	248	4.00	460		
2.50	104	3.30	270	4.10	490		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1908 and 1909, and on the form of previous curves. It is fairly well defined above gage height 2.3 feet.

Daily discharge, in second-feet, of Humboldt River near Oreana, Nev., for 1907 and 1908.

Day.	1907.								1908.				
	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1	.....	1,120	1,470	1,200	320	120	120	170	220	250	275	365	70
2	.....	1,100	1,470	1,220	310	115	120	170	230	250	275	365	70
3	.....	1,040	1,500	1,200	285	115	120	190	240	250	285	350	75
4	.....	1,040	1,600	840	275	125	120	190	250	250	300	350	75
5	.....	1,040	1,650	840	240	115	130	200	240	255	285	330	.....
6	.....	1,040	1,680	980	240	115	130	210	230	260	310	320	.....
7	.....	1,020	1,700	710	230	115	140	220	250	270	300	260	.....
8	.....	1,000	1,700	680	200	110	140	220	240	280	320	225	.....
9	.....	1,020	1,720	690	190	115	130	220	230	280	320	165	.....
10	.....	1,020	1,740	680	190	115	130	200	240	280	320	165	.....
11	.....	900	1,760	660	180	115	130	210	230	290	335	185	.....
12	.....	900	1,760	620	190	115	130	210	230	305	335	165	.....
13	.....	920	1,740	580	190	110	140	220	230	305	345	165	.....
14	.....	960	1,650	570	160	110	140	200	240	305	388	165	.....
15	.....	960	1,620	550	160	115	145	200	240	290	390	160	.....
16	.....	980	1,570	540	160	115	145	220	240	290	365	160	.....
17	1,650	980	1,740	510	150	115	155	200	265	290	365	150	.....
18	1,600	1,000	1,450	500	150	115	155	200	265	280	355	145	.....
19	1,580	1,000	1,430	480	150	115	145	190	275	280	355	135	.....
20	1,560	1,020	1,430	440	145	115	145	190	275	290	345	130	.....
21	1,190	950	1,400	440	145	115	155	185	275	280	345	130	.....
22	1,190	950	1,380	430	145	115	165	200	265	280	335	120	.....
23	1,080	960	1,380	415	135	125	165	210	265	280	325	120	.....
24	1,080	1,000	1,360	400	135	120	165	200	275	280	335	115	.....
25	1,060	1,260	1,320	375	135	120	155	200	275	270	345	110	.....
26	1,140	1,100	1,360	365	130	130	155	210	275	270	360	100	.....
27	1,200	1,140	1,360	355	120	130	165	210	265	270	360	95	.....
28	1,200	1,210	1,340	355	120	140	165	220	265	260	375	80	.....
29	1,200	1,240	1,300	340	120	130	170	210	250	260	375	80	.....
30	1,200	1,260	1,280	315	120	120	170	210	250	.....	360	75	.....
31	1,220	.....	1,240	290	.....	120	.....	220	250	.....	360	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Humboldt River near Oreana, Nev., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	238	75	167	10,300	C.
February	635	260	427	23,700	C.
March	1,130	635	835	51,300	C.
April	2,190	1,190	1,760	105,000	C.
May	2,220	1,060	1,650	101,000	C.
June	1,260	900	1,040	61,900	C.
July	1,760	1,240	1,520	93,500	C.
August	1,220	290	599	36,800	C.
September	320	120	181	10,800	C.
October	140	110	118	7,260	C.
November	170	120	145	8,630	C.
December	220	170	203	12,500	D.
The year	2,220	75	720	588,000	
1908.					
January	275	220	251	15,400	D.
February	305	.....	276	15,900	D.
March	390	275	337	20,700	C.
April	365	75	183	10,900	C.
May	75	32	58.0	3,570	C.
June	38	16	27.7	1,650	C.
July	670	16	390	24,000	C.
August	345	78	192	11,800	C.
September	78	38	57.7	3,430	C.
October	43	38	40.9	2,510	C.
November	78	38	57.0	3,390	C.
December	.....	.....	100	6,150	D.
The year	670	16	164	119,000	

NOTE.—Discharges estimated January 29 to February 7, and December, 1908.

NORTH FORK OF HUMBOLDT RIVER NEAR HALLECK,[a] NEV.

This station, which was established October 10, 1902, is located one-fourth mile above the mouth of North Fork, 2 miles west of Elburz station, on the Southern Pacific Railroad, and about 6 miles west of Halleck, the nearest post-office. Records at this point show the total flow of the river.

The channel is somewhat shifting, and the results are therefore only approximate. The gage heights also seem to be affected by backwater from the main Humboldt.

Discharge measurements of North Fork of Humboldt River near Halleck, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 14	Nicholas and Porter	43	121	4.70	286
June 21	E. A. Porter	41	139	5.30	349
June 30	La Rue and Porter	41	120	5.10	278
July 18	E. A. Porter	39	53	4.10	102
August 16	do	27	20	3.05	22
1908.					
March 16	E. A. Porter	39	49	3.70	81
May 8	do	24	20	2.90	16
July 17	do	22	11	3.10	9

[a] This station has heretofore been referred to as "near Elburz, Nev."

Daily gage height, in feet, of North Fork of Humboldt River near Halleck, Nev., for 1907 and 1908.

[A. R. Blevins and F. C. Engel, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.2	3.4	4.2	5.2	4.9	4.3	5.4	3.5	2.8	2.8	3.0	2.9
2	3.2	3.5	4.0	5.4	4.8	4.3	5.3	3.5	2.8	2.8	3.0	2.95
3	3.2	3.6	4.0	5.5	4.75	4.4	5.3	3.6	2.8	2.7	3.0	3.0
4	3.2	3.75	4.0	5.6	4.7	4.8	5.3	3.5	2.9	2.6	3.05	3.05
5	3.2	3.9	4.0	5.7	4.6	5.4	5.3	3.5	3.0	2.5	3.05	3.1
6	3.2	3.95	4.1	5.5	4.6	5.8	5.4	3.4	3.0	2.6	3.1	3.15
7	3.2	4.5	4.2	5.4	4.5	6.1	5.4	3.4	2.9	2.7	3.1	3.2
8	3.2	4.7	4.3	5.3	4.5	6.5	5.3	3.3	2.9	2.8	3.1	3.2
9	3.2	4.7	4.5	5.4	4.5	6.6	5.1	3.3	2.9	2.8	3.15	3.2
10	3.2	4.7	4.3	5.6	4.4	6.3	4.8	3.2	2.9	3.0	3.1	3.2
11	3.2	4.7	4.2	5.6	4.5	6.1	4.7	3.2	2.8	3.1	3.1	3.2
12	3.2	4.7	4.1	5.8	4.5	6.1	4.5	3.2	2.8	3.1	3.1	3.25
13	3.2	4.75	4.0	5.9	4.6	6.1	4.4	3.1	2.8	3.1	3.1	3.25
14	3.2	4.75	4.0	6.0	4.7	6.4	4.3	3.1	2.8	3.1	3.1	3.3
15	3.2	4.75	3.9	6.4	4.7	6.6	4.3	3.1	2.8	3.1	3.1	3.3
16	3.2	4.75	3.9	6.5	4.6	6.6	4.2	3.0	2.8	3.15	3.1	3.3
17	3.2	.....	3.9	6.7	4.4	6.6	4.2	3.0	2.7	3.15	3.1	3.3
18	3.2	.....	3.9	6.8	4.3	6.1	4.1	2.9	2.8	3.15	3.1	3.25
19	3.2	.....	4.1	6.8	4.3	5.8	4.1	2.9	2.9	3.15	3.1	3.25
20	3.2	.....	4.5	6.8	4.3	5.5	4.0	2.8	2.9	3.15	3.1	3.2
21	3.2	.....	4.7	6.6	4.3	5.3	4.0	2.8	2.8	3.2	3.1	3.2
22	3.2	.....	5.6	6.2	4.4	5.2	3.9	2.8	2.7	3.2	3.1	3.2
23	3.2	.....	6.0	6.0	4.6	5.4	3.9	2.7	2.7	3.2	3.1	3.2
24	3.2	4.75	6.2	5.8	4.7	5.9	3.8	2.8	2.8	3.2	3.1	3.25
25	3.2	4.8	5.9	5.5	5.0	5.9	3.8	2.8	2.8	3.2	3.1	3.25
26	3.2	4.8	5.6	5.3	5.2	5.8	3.7	2.8	2.8	3.2	3.05	3.3
27	3.2	4.7	5.5	5.1	5.1	5.6	3.7	2.8	2.8	3.15	3.0	3.3
28	3.2	4.5	5.3	5.1	5.0	5.5	3.7	2.8	2.8	3.1	3.0	3.3
29	3.2	.....	5.1	5.0	4.9	5.3	3.7	2.8	2.75	3.1	2.95	3.3
30	3.2	.....	5.2	4.9	4.6	5.2	3.6	2.8	2.7	3.0	2.9	3.3
31	3.3	.....	5.2	.....	4.4	.....	3.6	2.8	.....	3.0	.....	3.3
1908.												
1	3.35	3.2	3.4	3.4	3.1	2.9	4.0	2.7	2.4	2.4	3.0	.....
2	3.35	3.3	3.45	3.4	3.05	3.0	3.7	2.7	2.4	2.4	3.0	.....
3	3.4	3.3	3.4	3.5	3.0	3.0	3.5	2.7	2.4	2.45	3.0	.....
4	3.4	3.4	3.3	3.45	3.0	3.1	3.3	2.6	2.4	2.45	3.0	.....
5	3.4	3.35	3.35	3.45	2.9	3.3	3.3	2.6	2.4	2.45	3.0	.....
6	3.4	3.4	3.3	3.45	2.8	3.3	3.2	2.6	2.4	2.5	3.0	.....
7	3.4	3.4	3.3	3.45	2.7	3.3	3.0	2.6	2.5	2.5	3.0	.....
8	3.4	3.4	3.3	3.4	2.8	3.3	3.0	2.6	2.6	2.5	3.0	.....
9	3.4	3.4	3.25	3.4	3.0	3.5	2.9	2.6	2.6	2.5	.....	.....
10	3.4	3.4	3.2	3.35	2.9	3.45	2.8	2.6	2.55	2.5	.....	.....
11	3.4	3.4	3.2	3.2	3.0	3.5	2.8	2.6	2.5	2.5	.....	.....
12	3.4	3.3	3.25	3.1	3.0	3.65	3.0	2.6	2.5	2.5	.....	.....
13	3.4	3.25	3.3	3.15	3.0	3.8	3.0	2.6	2.5	2.5	.....	.....
14	3.4	3.2	3.4	3.15	3.0	4.0	3.1	2.6	2.45	2.55	.....	3.0
15	3.4	3.3	3.6	3.2	3.0	4.4	3.1	2.6	2.4	2.55	.....	3.0
16	3.4	3.4	3.7	3.2	3.0	4.6	3.1	2.6	2.4	2.55	.....	3.1
17	3.4	3.3	4.0	3.2	3.0	4.9	3.1	2.6	2.4	2.55	.....	3.1
18	3.4	3.25	4.1	3.2	3.0	5.3	3.1	2.6	2.4	2.6	.....	3.1
19	3.4	3.3	3.8	3.2	2.95	5.5	3.0	2.5	2.4	2.6	.....	3.1
20	3.3	3.25	3.7	3.3	2.95	5.7	3.0	2.55	2.4	2.6	.....	3.1
21	3.2	3.2	3.6	3.25	2.9	5.5	3.0	2.6	2.4	2.7	.....	3.0
22	3.2	3.2	3.55	3.25	2.95	5.0	3.0	2.6	2.4	2.8	.....	3.0
23	3.15	3.25	3.5	3.3	3.0	4.8	3.0	2.6	2.4	2.8	.....	3.0
24	3.2	3.2	3.45	3.25	3.0	4.5	2.8	2.6	2.4	2.8	.....	3.0
25	3.2	3.25	3.4	3.2	3.0	4.3	2.8	2.6	2.4	2.8	.....	3.0
26	3.2	3.3	3.4	3.2	2.9	4.3	2.8	2.6	2.4	2.95	.....	3.0
27	3.2	3.3	3.45	3.25	2.8	4.0	2.8	2.55	2.4	3.0	.....	3.1
28	3.2	3.3	3.5	3.2	2.7	4.9	2.75	2.5	2.4	3.0	.....	3.1
29	3.25	3.4	3.4	3.15	2.7	4.7	2.7	2.4	2.4	3.0	.....	3.2
30	3.2	.....	3.4	3.15	2.7	4.6	2.7	2.4	2.4	3.0	.....	3.3
31	3.2	.....	3.45	.....	2.8	.....	2.7	2.4	.....	3.0	.....	3.4

NOTE.—Ice conditions December 29 to 31, 1908, and possibly at other times.

Rating tables for North Fork of Humboldt River near Halleck, Nev.

JANUARY 1 TO MAY 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	27	4.20	144	5.20	400	6.20	810
3.30	34	4.30	165	5.30	495	6.30	845
3.40	42	4.40	189	5.40	530	6.40	880
3.50	51	4.50	217	5.50	565	6.50	915
3.60	61	4.60	250	5.60	600	6.60	950
3.70	72	4.70	285	5.70	635	6.70	985
3.80	84	4.80	320	5.80	670	6.80	1,020
3.90	97	4.90	355	5.90	705		
4.00	111	5.00	390	6.00	740		
4.10	126	5.10	425	6.10	775		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906–7, and is not well defined.

JUNE 1 TO AUGUST 31, 1907.

2.70	8	3.70	61	4.70	194	5.70	452
2.80	11	3.80	70	4.80	216	5.80	484
2.90	14	3.90	80	4.90	238	5.90	516
3.00	18	4.00	90	5.00	260	6.00	550
3.10	23	4.10	102	5.10	284	6.20	618
3.20	28	4.20	114	5.20	310	6.40	690
3.30	33	4.30	126	5.30	336	6.60	762
3.40	38	4.40	140	5.40	364		
3.50	44	4.50	156	5.50	392		
3.60	52	4.60	174	5.60	422		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1906–7, and is fairly well defined above gage height 2.9 feet.

SEPTEMBER 1, 1907, TO JUNE 20, 1908.

2.50	4	3.40	46	4.30	185	5.20	395
2.60	6	3.50	56	4.40	205	5.30	420
2.70	8	3.60	68	4.50	225	5.40	445
2.80	11	3.70	81	4.60	245	5.50	470
2.90	15	3.80	95	4.70	270	5.60	500
3.00	19	3.90	111	4.80	295	5.70	530
3.10	24	4.00	128	4.90	320		
3.20	30	4.10	146	5.00	345		
3.30	37	4.20	165	5.10	370		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1907–8 and the general form of previous curves, and is well defined between gage heights 2.9 feet and 3.7 feet.

JUNE 21 TO DECEMBER 31, 1908.

2.40	0.5	3.30	16	4.20	113	5.10	325
2.50	1.0	3.40	21	4.30	130	5.20	355
2.60	1.5	3.50	28	4.40	148	5.30	385
2.70	2	3.60	36	4.50	167	5.40	420
2.80	3	3.70	46	4.60	190	5.50	455
2.90	4	3.80	56	4.70	215	5.60	490
3.00	6	3.90	68	4.80	240	5.70	530
3.10	9	4.00	82	4.90	265		
3.20	12	4.10	97	5.00	295		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made in July, 1908, and the general form of previous curves, and is only approximate.

Monthly discharge of North Fork of Humboldt River near Halleck, Nev., for 1907 and 1908.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	34	27	27.2	0.027	0.03	1,670	D.
February	320	42	244	.239	.25	13,600	C.
March	810	97	283	.278	.32	17,400	C.
April	1,020	355	663	.650	.73	39,500	D.
May	460	165	263	.258	.30	16,200	C.
June	762	126	479	.470	.52	28,500	C.
July	364	52	170	.167	.19	10,500	C.
August	52	8	23.1	.023	.03	1,420	C.
September	19	8	12.0	.012	.01	714	C.
October	30	4	20.7	.020	.02	1,270	C.
November	27	15	18.5	.018	.02	1,100	C.
December			20.0	.020	.02	1,230	D.
The year	1,020	4	185	.182	2.44	133,000	
1908.							
January			20.0	.020	.02	1,230	D.
February			30.0	.029	.03	1,730	D.
March	146	30	55.5	.054	.06	3,410	C.
April	51	24	36.6	.036	.04	2,180	C.
May	24	8	16.1	.016	.02	990	C.
June	530	15	168	.165	.18	10,000	C.
July	82	2	10.6	.010	.01	652	C.
August	2	.5	1.35	.0003	.001	83.0	D.
September	1.5	.5	.67	.00066	.001	39.9	D.
October	6	.5	2.26	.0022	.003	139	D.
November	6	6	6.0	.0059	.007	357	D.
December	9	6	7.0	.0069	.008	430	D.
The year	530	.5	29.5	.029	.38	21,200	

NOTE.—Discharges interpolated February 17 to 23, 1907, and November 9 to December 13, 1908; estimated on account of ice conditions December, 1907, January and February, 1908.

SOUTH FORK OF HUMBOLDT RIVER NEAR ELKO, NEV.

This station, which was established August 29, 1906, to determine the amount of water available for storage, is located about 12 miles southwest of Elko, Nev., 6 miles above the mouth of the river, and is above the proposed reservoir site of the United States Reclamation Service. As the station is below all tributaries the records show the total run-off from the basin of the South Fork.

The river freezes during two or three months of the winter, the ice probably reaching a considerable thickness, but information as to winter conditions is very meager.

The gage was removed February 26, 1907, about 1,000 feet upstream; and gage heights since that time bear no determined relation to previous readings. The channel at the station is somewhat shifting. During 1908 the gage heights were affected by the raising of a diversion dam below. As sufficient measurements have not yet been made to indicate the extent of these changes the published estimates of discharge are only approximate.

Discharge measurements of South Fork of Humboldt River near Elko, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 15	Nicholas and Porter	50	113	3.80	383
June 22	E. A. Porter	47	193	5.70	1,040
July 19	do	47	138	4.10	576
August 17	do	45	53	2.20	82
November 28	do	44	40	1.80	48
1908.					
March 17	E. A. Porter	48	83	2.90	166
May 9	do	47	70	2.80	121
July 16	do	48	86	3.50	203

Daily gage height, in feet, of South Fork of Humboldt River near Elko, Nev., for 1907 and 1908.

[James Cowling, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.1	.....	1.6	3.5	3.35	3.95	5.65	3.5	1.9	1.9	1.9	1.8
2	1.1	.....	1.6	3.35	3.3	4.25	5.75	3.4	1.8	1.9	1.9	1.8
3	1.1	.....	1.6	3.55	3.05	5.05	5.7	3.3	1.8	1.9	1.8	1.8
4	1.1	.....	1.5	3.45	2.9	5.6	5.9	3.15	1.8	1.9	1.8	1.8
5	1.1	.....	1.55	3.4	3.0	5.9	6.1	2.9	1.9	1.9	1.8	1.8
6	1.1	.....	1.85	3.35	3.0	5.95	5.85	2.75	1.9	1.8	1.8	1.8
7	1.1	.....	1.95	3.15	3.0	6.05	5.55	2.65	1.9	1.8	1.8	1.8
8	1.1	.....	1.9	3.05	3.0	6.35	5.3	2.45	1.9	1.7	1.8	1.9
9	1.1	.....	1.8	3.0	3.1	6.2	5.05	2.4	1.9	1.7	1.8	1.9
10	1.1	.....	1.7	3.15	3.1	5.95	4.8	2.45	1.8	1.7	1.8	1.9
11	1.1	.....	1.7	3.35	3.2	5.7	4.75	2.4	1.8	1.8	1.8	1.9
12	1.1	.....	1.75	3.6	3.85	5.55	4.85	2.35	1.8	1.85	1.7	1.9
13	1.1	.....	1.75	3.95	4.1	6.0	4.85	2.4	1.8	2.0	1.7	1.9
14	1.1	.....	1.65	4.1	4.05	6.2	4.45	2.35	1.7	1.9	1.7	1.9
15	1.1	.....	1.65	4.5	3.85	6.2	4.3	2.3	1.7	1.9	1.7	1.9
16	1.1	.....	1.65	4.7	3.7	6.15	4.15	2.3	1.7	1.8	1.7	1.9
17	1.1	.....	2.55	4.45	3.85	6.2	4.05	2.25	1.7	1.8	1.7	1.9
18	1.1	.....	2.75	4.15	3.95	6.25	3.9	2.15	1.7	1.8	1.7	1.9
19	1.1	.....	2.9	3.95	4.3	5.85	3.95	2.05	1.7	1.8	1.7	1.9
20	1.1	.....	3.15	3.75	4.6	5.55	3.95	2.0	1.7	1.7	1.7	1.9
21	1.1	.....	3.3	3.55	4.7	5.6	3.85	2.0	1.8	1.7	1.7	1.9
22	1.1	.....	3.5	3.4	4.8	5.65	3.85	1.9	1.8	1.7	1.7	1.9
23	1.1	.....	3.35	3.4	4.7	5.7	3.7	1.8	1.8	1.7	1.7	1.9
24	1.1	.....	3.15	3.3	4.8	5.7	3.6	1.8	1.8	1.7	1.8	1.9
25	1.1	.....	3.1	3.3	4.8	5.6	3.6	1.8	1.7	1.7	1.8	1.9
26	1.1	1.7	3.0	3.3	4.5	5.55	3.95	1.8	1.7	1.7	1.8	1.9
27	.....	1.65	2.95	3.4	4.15	5.5	3.65	1.8	1.7	1.7	1.8	2.0
28	.....	1.55	3.0	3.4	4.1	5.35	3.7	1.9	1.7	1.7	1.8	2.0
29	.....	.....	3.0	3.35	3.95	5.25	3.55	1.9	1.85	1.75	1.8	2.0
30	.....	.....	3.35	3.3	3.9	5.15	3.5	1.9	1.9	1.85	1.8	1.9
31	.....	.....	3.35	.....	4.05	.....	3.45	1.9	.....	1.9	.....	1.9
1908.												
1	1.9	2.2	2.15	2.35	2.4	3.75	4.5	2.5	2.0	2.1	2.2	2.3
2	1.9	2.3	2.05	2.3	2.5	4.0	4.5	2.5	2.0	2.1	2.2	2.3
3	1.9	2.3	2.0	2.3	2.5	3.95	4.55	2.5	2.0	2.1	2.2	2.3
4	1.9	2.3	2.0	2.3	2.5	3.85	4.55	2.5	2.0	2.2	2.2	2.3
5	1.9	2.3	2.0	2.2	2.5	4.0	4.65	2.5	2.0	2.2	2.2	2.3
6	1.9	2.3	2.0	2.2	2.65	4.0	4.55	2.5	2.0	2.2	2.2	2.3
7	1.9	2.3	2.0	2.2	2.8	4.0	4.45	2.4	2.05	2.0	2.2	2.3
8	1.9	2.3	1.9	2.2	2.8	4.15	4.25	2.4	2.25	2.0	2.2	2.3
9	1.9	2.3	1.95	2.2	2.8	4.35	4.15	2.4	2.2	2.05	2.2	2.3
10	1.9	2.3	1.95	2.2	2.7	4.45	3.95	2.35	2.1	2.1	2.2	2.3
11	1.9	2.3	1.95	2.2	2.7	4.65	3.75	2.2	2.1	2.1	2.2	2.3
12	1.9	2.1	2.05	2.35	2.6	4.85	3.65	2.1	2.1	2.1	2.2	2.3
13	1.9	2.0	2.05	2.45	2.6	5.0	3.85	2.1	2.1	2.1	2.2	2.3
14	1.9	2.0	2.15	2.55	2.5	5.3	3.75	2.0	2.1	2.1	2.2	2.3
15	2.0	2.0	2.25	2.6	2.5	5.5	3.6	2.0	2.1	2.1	2.3	2.3

Daily gage height, in feet, of South Fork of Humboldt River near Elko, Nev., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	2.1	2.25	2.45	2.6	2.6	5.6	3.55	2.1	2.0	2.1	2.3	2.3
17	2.1	2.2	2.95	2.6	2.6	5.75	3.45	2.2	2.0	2.1	2.3	2.3
18	2.2	2.2	2.9	2.6	2.6	5.7	3.35	2.2	2.0	2.1	2.3	2.3
19	2.2	2.2	2.75	2.7	2.6	5.45	3.3	2.1	2.0	2.1	2.3	2.3
20	2.3	2.2	2.7	2.7	2.75	5.1	3.25	2.0	2.0	2.1	2.3	2.3
21	2.3	2.05	2.6	2.75	2.7	4.7	3.2	2.0	2.0	2.1	2.3	2.3
22	2.4	2.0	2.55	2.8	2.85	4.45	3.3	2.0	2.0	2.1	2.3	2.3
23	2.5	2.1	2.5	2.8	3.0	4.3	3.25	2.0	2.0	2.1	2.3	2.3
24	2.5	2.2	2.5	2.7	3.0	4.2	3.15	2.0	2.0	2.1	2.3	2.3
25	2.5	2.25	2.5	2.7	3.0	4.3	3.05	2.0	2.0	2.1	2.3	2.3
26	2.3	2.4	2.45	2.5	3.1	4.45	3.0	2.0	2.0	2.1	2.3	2.3
27	2.3	2.35	2.4	2.35	3.2	4.5	2.95	2.0	2.1	2.1	2.3	2.3
28	2.3	2.25	2.4	2.35	3.25	4.6	2.9	2.0	2.1	2.2	2.3	2.3
29	2.2	2.25	2.4	2.3	3.3	4.6	2.85	2.0	2.1	2.2	2.3	2.3
30	2.2	.....	2.4	2.3	3.35	4.5	2.7	2.0	2.1	2.2	2.3	2.3
31	2.2	.....	2.4	.....	3.45	.....	2.6	2.0	.....	2.2	.....	2.3

NOTE.—The gage was washed out January 27 and reestablished February 26, 1907, about 1,000 feet upstream. Probable ice conditions during the greater part of December, 1907. Ice conditions January 1 to February 21 and November 25 to December 31, 1908. A diversion dam was put in about January 16, 1908, and raised May 5 to 6 and May 22, 1908. This affected the gage readings considerably.

Rating tables for South Fork of Humboldt River near Elko, Nev.

JANUARY 1 TO 26, 1907.

[1906 table used. Gage height 1.10 feet = 18 second-feet.]

FEBRUARY 26, 1907, TO JANUARY 15, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	20	2.60	148	3.70	402	4.80	732
1.60	27	2.70	166	3.80	428	4.90	766
1.70	34	2.80	186	3.90	456	5.00	800
1.80	43	2.90	208	4.00	484	5.20	868
1.90	53	3.00	232	4.10	514	5.40	936
2.00	64	3.10	256	4.20	544	5.60	1,004
2.10	75	3.20	280	4.30	574	5.80	1,072
2.20	87	3.30	304	4.40	604	6.00	1,140
2.30	100	3.40	328	4.50	634	6.20	1,208
2.40	114	3.50	352	4.60	666	6.40	1,276
2.50	130	3.60	376	4.70	698		

NOTE.—This table is not applicable for ice or obstructed channel conditions. It is based on 5 discharge measurements made during 1907, and is fairly well defined between gage heights 2.0 feet and 6.0 feet. Below gage height 2.0 feet the rating curve is very uncertain.

JANUARY 16 TO MAY 6, 1908.

1.90	33	2.20	62	2.50	98	2.80	146
2.00	42	2.30	73	2.60	113	2.90	166
2.10	52	2.40	85	2.70	129	3.00	186

NOTE.—This table is not applicable for ice conditions. It is based on one discharge measurement made during 1908 and the form of the 1907 curve, and is not well defined. The channel was obstructed during this period by a diversion dam below.

MAY 7 TO 21, 1908.

2.50	78	2.60	91	2.70	105	2.80	121

NOTE.—This table is not applicable for ice conditions. It is based on one discharge measurement made during the period covered, and is fairly well defined. The diversion dam below was raised about May 6, changing the rating.

Rating tables for South Fork of Humboldt River near Elko, Nev.—Continued.

MAY 23 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	15	2.90	95	3.80	268	4.70	502
2.10	21	3.00	110	3.90	292	4.80	532
2.20	27	3.10	126	4.00	316	4.90	562
2.30	34	3.20	144	4.10	340	5.00	594
2.40	42	3.30	162	4.20	366	5.20	658
2.50	50	3.40	182	4.30	392	5.40	726
2.60	59	3.50	203	4.40	418	5.60	796
2.70	70	3.60	224	4.50	444	5.80	868
2.80	82	3.70	246	4.60	472		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1908, and is well defined only for medium stages in midsummer. For low water it is only approximate. The last change in the diversion dam noted by the observer occurred on May 22, and raised the gage height 0.3 foot or about the same as the difference between this and the previous table. The dam has been assumed to remain constant until the end of the year.

Monthly discharge of South Fork of Humboldt River near Elko, Nev., for 1907 and 1908.

[Drainage area, 1,150 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	.....	.....	18.0	0.016	0.02	1,100	D.
February	.....	.....	25.0	.022	.02	1,390	D.
March	364	20	143	.124	.14	8,790	C.
April	698	232	376	.327	.36	22,400	B.
May	732	208	450	.391	.45	27,700	B.
June	1,260	470	1,030	.896	1.00	61,300	B.
July	1,170	340	649	.564	.65	39,900	B.
August	352	43	118	.103	.12	7,260	B.
September	53	34	42.2	.037	.04	2,510	C.
October	64	34	42.9	.037	.04	2,640	C.
November	53	34	40.1	.035	.04	2,390	C.
December	.....	.....	40.7	.035	.04	2,500	D.
The year	1,260	.....	248	.216	2.92	180,000	
1908.							
January	.....	.....	46.1	.040	.05	2,830	D.
February	85	.....	51.9	.045	.05	2,990	D.
March	176	33	77.8	.068	.08	4,780	D.
April	146	62	93.6	.081	.09	5,570	D.
May	192	78	112	.097	.11	6,890	C.
June	850	257	486	.423	.47	28,900	C.
July	487	59	245	.213	.25	15,100	B.
August	50	15	27.1	.024	.03	1,670	D.
September	30	15	18.0	.016	.02	1,070	D.
October	27	15	21.9	.019	.02	1,350	D.
November	34	27	29.9	.026	.03	1,780	D.
December	.....	.....	25.0	.022	.03	1,540	D.
The year	850	15	103	.089	1.23	74,400	

NOTE.—Discharges estimated January 27 to February 25, 1907; estimated on account of ice conditions December 8, 1907 to February 21, 1908, and November 25 to December 31, 1908.

SIERRA NEVADA DRAINAGE AREA.

PRINCIPAL STREAMS.

The Sierra Nevada drainage area includes the western part of Nevada, the eastern part of California, and a small part of south-central Oregon. The principal rivers of the area are Truckee River, discharging into Pyramid and Winnemucca lakes; Walker River, flowing into Walker Lake; Carson River, emptying into Carson Sink; Susan River, which flows into Honey Lake; and Owens River, discharging into Owens Lake.

TRUCKEE RIVER BASIN.

DESCRIPTION.

The Truckee River system comprises the main river and several minor tributaries, all having as their chief sources of supply small mountain lakes. Truckee River itself is the natural outlet of Lake Tahoe, a beautiful mountain lake, 193 square miles in area, lying at an elevation of more than 6,000 feet above sea, and noted as the largest body of fresh water in the United States at so high an altitude. Nearly three-fourths of the lake is in California and the rest is in Nevada.

Issuing from the northwest side of Lake Tahoe the Truckee flows almost due north to the town of Truckee, Cal., where it turns to the east. At Wadsworth, Nev., the river again turns north and discharges into Pyramid and Winnemucca lakes, saline bodies of water without outlets. From the lake to Verdi, Nev., a distance of 35 miles, the country is heavily timbered with fir and pine; below Verdi barren wastes alternate with small and fertile valleys—the Verdi Valley, the Reno or Truckee Valley, and the Wadsworth Valley. All three have a rich, productive soil. The total length of the Truckee is about 110 miles and its total fall is about 2,350 feet.

Donner Creek, the natural outlet of Donner Lake, is the first important tributary of the Truckee, which it enters at the town of Truckee. Prosser Creek, the second tributary, and the natural outlet of several small lakes, enters about 5 miles northeast of Truckee, and Little Truckee River, the natural outlet of Webber and Independence lakes, comes in at Boca, Cal., about 2 miles farther along. Each of these tributaries rises at an elevation of 6,000 feet above sea level, and each flows from a lake whose capacity can be enlarged by building a dam across its outlet. The region about the lakes is thickly forested and receives during the winter months very heavy snowfall. During the season of thaw this snow affords an immense run-off, almost all of which could be stored by enlarging the natural lakes.

PORTION OF LAKE TAHOE.

Three power plants have been installed on the Truckee: The Farad (Mystic), Fleish, and Washoe plants, with an emergency plant near Reno, Nev. (See Pl. V, *B*.) The plants have an average capacity of about 2,500 horsepower each and they supply practically all the power used by the towns of Verdi, Reno, Carson City, Yerington, Gardnerville, Sparks, and Virginia City, Nev. There are many falls on the headwaters of the small tributaries. (See Pl. V, *A*.)

Almost all of the minimum flow of the river is appropriated for irrigation, but further storage development would make more water available for both irrigation and power.

Within the period covered by the records, 1907 was by far the wettest year and 1900 the driest year. The ratio in the two years for the state line station was about 3.4 to 1.

The following gaging stations have been maintained in the Truckee River basin:

Lake Tahoe at Tahoe, Cal., 1900–1901, 1907–8.
Truckee River at Tahoe, Cal., 1895, 1900–1908.
Truckee River near Boca, Cal., 1890.
Truckee River at Nevada-California state line, 1899–1908.
Truckee River near Laughtons, Nev., 1890.
Truckee River at Reno, Nev., 1906–1908.
Truckee River near Essex, Nev., 1889.
Truckee River at Vista, Nev., 1890–91, 1899–1907.
Truckee River at Derby dam, Nev., 1907–8.
Truckee River near Wadsworth, Nev., 1902–1905.
Lake Winnemucca Inlet near Wadsworth, Nev., 1902–1905.
Donner Creek near Truckee, Cal., 1902–1908.
Prosser Creek near Hobart Mills, Cal., 1903–4, 1907–8.
Prosser Creek near Boca, Cal., 1889–90, 1902–3.
Independence Creek below Independence Lake, Cal., 1902–1906.
Little Truckee River at Pine Station and Starr, Cal., 1903–1908.
Little Truckee River near Boca Cal., 1890.
Steamboat Creek at Steamboat Springs, Nev., 1900–1901.

LAKE TAHOE AT TAHOE, CAL.

Lake Tahoe lies on the boundary between Nevada and California, at an elevation of 6,225 feet above sea level, and has an area of 124,000 acres, or about 193 square miles. It is the largest body of water at so high an elevation in the United States. (See Pl. IV.)

Records of the height of the lake have been kept to determine its fluctuation and the approximate amount of water drawn from storage.

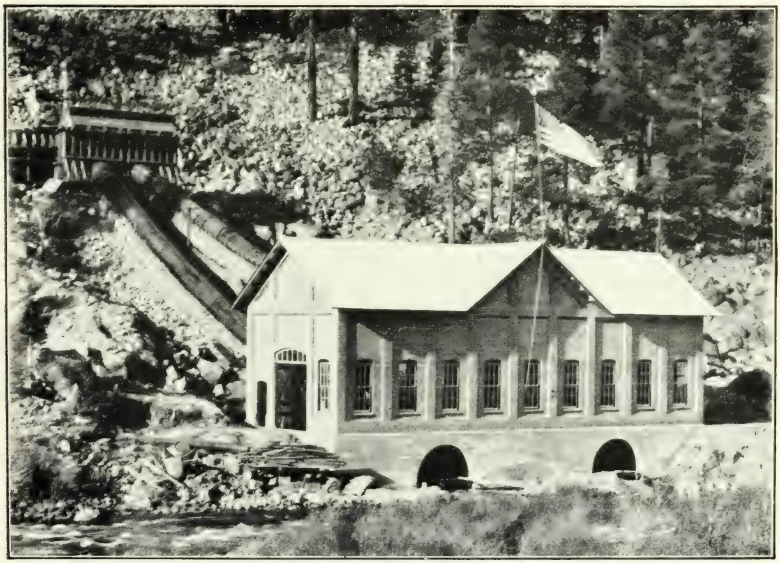
Daily gage height, in feet, of Lake Tahoe at Tahoe, Cal., for 1907 and 1908.

[J. U. Haley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1						4.95		5.67				2.80
2					4.30	5.00	5.65	5.65	4.88		3.44	2.78
3							5.70	5.65			3.42	2.76
4								5.63			3.40	
5								5.60		3.90	3.38	
6				3.85					4.80		3.36	
7									4.78			
8				3.90	4.42				4.75			
9						5.18	5.72		4.73			
10							5.74		4.71	3.85	3.30	
11				3.88			5.73	5.42		3.83	3.28	2.90
12							5.73			3.82	3.25	2.90
13							5.75	5.40		3.80	3.22	2.90
14				3.95	4.60		5.76	5.37		3.80	3.20	2.90
15				4.00	4.58	5.40	5.76	5.35		3.78		
16					4.58		5.75	5.33		3.76		
17				4.05	4.60	5.40	5.76	5.32		3.74		2.88
18				4.10	4.64	5.42	5.76	5.30	4.40	3.70		
19						5.42		5.26		3.68	3.05	
20					4.70	5.42		5.25		3.66	3.00	2.90
21				4.10	4.72	5.43	5.73	5.24	4.33	3.64		
22				4.13			5.72	5.20	4.30		2.97	2.88
23				4.13	4.76	5.50	5.72	5.16	4.30			2.86
24				4.17	4.77	5.50	5.71	5.15		3.62	2.90	
25				4.20	4.80	5.52	5.72	5.10				
26						5.53	5.71	5.10	4.23			
27				4.24		5.55	5.70	5.08	4.20			
28							5.70			3.54		
29					4.85		5.69				3.83	2.88
30				4.30	4.88		5.69		4.10	3.50	2.80	
31					4.90		5.69					
1908.												
1	2.90								1.83	1.39	1.10	.90
2									1.80		1.10	
3									1.80		1.10	
4									1.80	1.31	1.10	
5									1.79	1.30	1.10	.90
6	2.80		2.25						1.78	1.28	1.10	.90
7			2.25	1.90						1.27	1.10	.85
8				1.90						1.26	1.06	
9	2.82		2.20					2.34	1.70	1.25	1.02	
10			2.15					2.32	1.73	1.25	1.00	
11	2.80		2.15					2.30	1.70	1.23	1.00	.80
12			2.10	1.90				2.27	1.70	1.20	1.00	.80
13			2.10	1.90					1.70	1.19	1.00	.80
14		2.48	2.10						1.70		1.00	
15		2.45	2.10	1.95							1.00	
16	2.72		2.10	1.95						1.25	.95	.80
17	2.70		2.10	1.95				2.15	1.60		.92	
18			2.10	2.00				2.15			.92	
19			2.10					2.10			.90	
20			2.10					2.10				.70
21								2.10	1.57			.70
22			2.05					2.08	1.56			
23	2.70							2.05		1.15		
24		2.25						2.03			1.00	.65
25		2.24						2.01				.62
26		2.20						2.00	1.50	1.20		
27									1.45	1.20		.62
28			1.90						1.45	1.20	.90	
29									1.40		.90	
30									1.40	1.15	.90	
31								1.82		1.12		

NOTE.—No records were obtained in January to March, 1907, and May to July, 1908. The gage was not read at other times when the lake was rough.

A. FALLS OF LITTLE TRUCKEE RIVER, ONE-HALF MILE BELOW WEBBER LAKE, CALIFORNIA.



B. POWER HOUSE OF TRUCKEE RIVER GENERAL ELECTRIC COMPANY AT MYSTIC, CAL.

TRUCKEE RIVER AT TAHOE, CAL.

This station, which is located at Tahoe, Cal., about one-fourth mile below the outlet of Lake Tahoe, was established June 17, 1900, to determine the total outflow of the lake and its value as a storage reservoir—information needed by the United States Reclamation Service in connection with the Truckee-Carson project.

A timber dam across the river about 500 feet from the lake completely regulates the flow of the river, sometimes causing sudden fluctuations and often cutting down the outflow 15 or 20 second-feet, or the amount of leakage through the dam.

The channel is liable to shift only in a slight degree and records are reliable. The datum of the gage has not been changed. The flow is practically unaffected by ice.

Discharge measurements of Truckee River at Tahoe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
May 22	Nicholas and Porter	83	297	3.50	879
June 27	E. A. Porter	128	460	4.10	1,250
1908.					
June 17	E. A. Porter	46	26	.60	19
July 8	M. B. Kennedy	78	155	1.90	328

Daily gage height, in feet, of Truckee River at Tahoe, Cal., for 1907 and 1908.

[J. U. Haley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.9	2.9	3.0	3.2	3.3	3.6	4.1	4.25	4.05	4.05	3.7	3.2
2	2.9	2.9	3.0	3.2	3.3	3.65	4.1	4.25	4.1	4.0	3.7	3.2
3	2.9	2.9	3.0	3.2	3.3	3.65	4.1	4.25	4.1	2.2	3.7	3.2
4	2.9	3.0	3.0	3.2	3.3	3.65	4.1	4.25	4.1	3.75	3.65	3.2
5	2.9	3.0	3.0	3.2	3.3	3.65	4.1	4.25	4.1	4.0	3.65	3.2
6	2.9	3.0	3.0	3.2	3.3	3.65	4.1	4.25	4.1	4.0	3.6	3.2
7	2.9	3.0	3.0	3.2	3.3	3.65	4.2	4.25	4.1	4.0	.....	3.2
8	2.9	3.0	3.0	3.2	3.35	3.65	4.2	4.25	4.05	4.0	3.5	3.2
9	2.9	3.0	3.0	3.2	3.35	3.7	4.2	4.25	4.05	4.0	3.5	3.3
10	2.9	3.0	3.0	3.2	3.35	3.8	4.2	4.25	4.1	4.0	3.5	3.3
11	2.9	3.0	3.0	3.2	3.35	3.9	4.2	4.1	4.1	3.65	3.5	3.3
12	2.9	3.0	3.0	3.2	3.4	3.95	4.2	4.1	4.1	4.0	3.5	3.3
13	2.9	3.0	3.0	3.2	3.4	4.0	4.3	4.0	4.05	4.0	3.5	3.3
14	2.9	3.0	3.0	2.65	3.45	4.0	4.3	4.1	4.05	3.95	3.5	3.3
15	2.9	3.0	3.0	2.9	3.45	4.0	4.3	4.1	4.0	3.95	3.5	3.3
16	2.9	3.0	3.0	3.2	3.45	3.95	4.3	4.1	4.0	3.95	3.45	3.3
17	2.9	3.0	3.0	3.2	3.45	3.95	4.3	4.05	3.9	3.9	3.45	3.2
18	2.9	3.0	3.0	3.2	3.45	3.95	4.3	4.05	3.95	3.85	3.45	3.2
19	2.9	3.0	3.0	3.2	3.45	4.0	4.3	4.1	4.0	3.85	3.4	3.2
20	2.9	3.0	3.0	3.2	3.5	4.0	4.3	4.1	4.0	3.85	3.4	3.2
21	2.9	3.0	3.2	3.2	3.5	4.0	4.25	4.1	4.0	3.8	3.35	3.2
22	2.9	3.0	3.2	3.2	3.5	4.0	4.25	4.05	4.0	3.8	3.35	3.2
23	2.9	3.0	3.2	3.2	3.5	4.0	4.25	4.1	4.0	3.8	3.3	3.2
24	2.9	3.0	3.2	3.2	3.5	4.0	4.25	4.1	4.1	3.8	3.3	3.2
25	2.9	3.0	3.2	3.2	3.5	4.0	4.25	4.05	4.1	3.75	3.3	3.2
26	2.9	8.0	3.2	3.2	3.6	4.0	4.25	4.05	4.1	3.75	3.3	3.2
27	2.9	3.0	3.2	3.2	3.6	4.1	4.25	4.05	4.1	3.75	3.25	3.2
28	2.9	3.0	3.2	3.2	3.6	4.1	4.25	4.1	4.1	3.75	3.25	3.1
29	2.9	.....	3.2	3.3	3.6	4.1	4.25	4.1	4.05	3.75	3.2	3.1
30	2.9	.....	3.2	3.3	3.6	4.1	4.25	4.1	4.05	3.7	3.2	3.1
31	2.9	.....	3.2	.....	3.6	.....	4.25	4.1	.....	3.7	.....	3.1

Daily gage height, in feet, of Truckee River at Tahoe, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	3.1	3.0	2.75	2.25	1.0	0.75	0.95	2.35	2.15	2.0	1.85	1.85
2	3.1	3.0	2.75	2.25	1.0	1.0	.95	2.35	2.15	2.0	1.85	1.85
3	3.1	3.0	2.75	2.25	1.0	1.0	.95	2.1	2.15	2.0	1.85	1.85
4	3.1	2.95	2.75	2.25	1.0	1.0	.95	2.1	2.0	2.0	1.85	1.85
5	3.1	2.95	2.75	2.25	1.0	1.0	.95	2.1	2.0	2.0	1.85	1.85
6	3.1	2.95	2.75	2.25	1.0	1.0	.95	2.35	2.15	2.0	1.85	1.8
7	3.1	2.95	2.75	2.25	1.0	1.0	1.8	2.35	2.15	2.1	1.85	1.8
8	3.1	2.9	2.75	1.7	1.0	1.0	1.8	2.35	2.15	2.1	1.85	1.8
9	3.1	2.9	2.75	1.7	1.1	1.0	1.2	2.35	2.1	2.1	1.8	1.75
10	3.1	2.85	2.7	1.7	1.1	.6	1.7	2.35	2.1	2.1	1.8	1.75
11	3.1	2.85	2.7	1.7	1.1	.6	1.7	2.35	2.1	2.1	1.8	1.75
12	3.1	2.85	2.7	1.7	.65	.6	1.7	2.35	2.1	2.05	1.8	1.7
13	3.05	2.85	2.7	1.3	.65	.6	1.7	2.35	2.1	2.05	1.8	1.7
14	3.05	2.85	2.7	1.3	.65	.6	1.7	2.35	2.1	2.05	1.8	1.7
15	3.05	2.8	2.7	1.3	.7	.6	1.7	2.35	2.1	1.95	1.8	1.7
16	3.05	2.8	2.7	1.3	.7	.6	1.7	2.35	2.1	2.0	1.8	1.7
17	3.0	2.8	2.7	1.3	.7	.6	1.9	2.3	2.1	2.0	1.8	1.7
18	3.0	2.8	2.7	1.0	.7	.6	1.9	2.3	2.1	2.0	1.8	1.75
19	3.0	2.8	2.7	1.0	.7	.6	1.9	2.3	2.1	1.95	1.8	1.75
20	3.0	2.8	2.7	1.0	.7	.6	1.9	2.25	2.1	1.95	1.8	1.75
21	3.0	2.75	2.7	1.0	.75	.6	2.35	2.25	2.1	1.95	1.8	1.75
22	3.0	2.75	2.65	1.0	.75	.6	2.35	2.25	2.1	1.95	1.8	1.7
23	3.0	2.75	2.65	1.0	.75	.95	2.35	2.25	2.05	1.9	1.8	1.7
24	3.0	2.75	2.65	1.0	.75	.95	2.35	2.25	2.05	1.9	1.8	1.7
25	3.0	2.7	2.65	1.0	.75	.95	2.35	2.25	2.05	1.9	1.8	1.7
26	3.0	2.7	2.65	1.0	.75	.95	2.35	2.25	2.05	1.9	1.8	1.7
27	3.0	2.7	2.6	1.0	.75	.95	2.35	2.2	2.05	1.9	1.8	1.7
28	3.0	2.7	2.6	1.0	.75	.95	2.35	2.2	2.05	1.9	1.8	1.7
29	3.0	2.75	2.25	1.0	.75	.95	2.35	2.2	2.05	1.9	1.8	1.65
30	3.0	.....	2.25	1.0	.75	.95	2.35	2.2	2.05	1.9	1.8	1.65
31	3.0	.....	2.25	.....	.75	.....	2.35	2.15	.....	1.85	.....	1.65

NOTE.—These gage heights are affected by the raising and lowering of the gates at the regulating dam Probably no ice conditions.

Rating tables for Truckee River at Tahoe, Cal.

FOR 1905 TO 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	453	2.80	659	3.40	902	4.00	1,182
2.30	485	2.90	697	3.50	946	4.10	1,234
2.40	518	3.00	736	3.60	991	4.20	1,288
2.50	552	3.10	776	3.70	1,037	4.30	1,344
2.60	586	3.20	817	3.80	1,084		
2.70	622	3.30	859	3.90	1,132		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1905 to 1907, and is fairly well defined.

FOR 1908.

0.30	0	1.10	110	1.90	327	2.70	612
.40	3	1.20	133	2.00	360	2.80	652
.50	9	1.30	157	2.10	393	2.90	692
.60	19	1.40	182	2.20	427	3.00	733
.70	33	1.50	209	2.30	462	3.10	775
.80	49	1.60	237	2.40	498	3.20	817
.90	67	1.70	266	2.50	535	3.30	859
1.00	88	1.80	296	2.60	573		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1908 and earlier measurements at high stages, and is not well defined.

Monthly discharge of Truckee River at Tahoe, Cal., for 1907 and 1908.

[Drainage area, 519 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	697	697	697	1.34	1.54	42,900	B.
February	736	697	732	1.41	1.47	40,700	B.
March	817	736	765	1.47	1.70	47,000	A.
April	859	604	806	1.55	1.73	48,000	A.
May	991	859	919	1.77	2.04	56,500	A.
June	1,230	991	1,130	2.18	2.43	67,200	A.
July	1,340	1,230	1,300	2.50	2.88	79,900	A.
August	1,320	1,180	1,250	2.41	2.78	76,900	A.
September	1,230	1,130	1,210	2.33	2.60	72,000	A.
October	1,210	453	1,100	2.14	2.47	67,600	A.
November	1,040	817	925	1.78	1.99	55,000	A.
December	859	776	823	1.59	1.83	50,600	B.
The year	1,340	453	971	1.87	25.43	704,000	
1908.							
January	775	733	752	1.45	1.67	46,200	B.
February	733	612	666	1.28	1.38	38,300	B.
March	632	444	596	1.15	1.33	36,600	A.
April	444	88	212	.408	.46	12,600	A.
May	110	26	56.8	.109	.13	3,490	A.
June	88	19	53.9	.104	.12	3,210	A.
July	480	78	311	.599	.69	19,100	A.
August	480	393	453	.873	1.01	27,900	A.
September	410	360	390	.751	.84	23,200	A.
October	393	312	354	.682	.79	21,800	A.
November	312	296	300	.578	.64	17,900	A.
December	312	252	278	.536	.62	17,100	B.
The year	775	19	369	.710	9.68	267,000	

NOTE.—The accuracy of winter records is probably not affected by ice conditions.

TRUCKEE RIVER AT NEVADA-CALIFORNIA STATE LINE.

This station, which is located at the state line, 17 miles west of Reno, Nev., was established September 1, 1899, to determine the quantity of water available for use in the Reno or Truckee Valley.

The station is below all tributaries which have their headwaters in the Sierra Nevada divide, and is above all diversions.

The gage is located at Farad, 2½ miles above the measuring section. The flow is probably unaffected by ice. The channel is somewhat shifting, requiring rerating after each high-water period. Flood measurements are made with difficulty owing to the high velocities of the current. Records are fairly reliable.

Discharge measurements of Truckee River at Nevada-California state line, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 25	E. A. Porter	105	487	5.30	3,860
June 1	do	100	597	6.10	5,910
July 16	do	92	433	4.40	2,420
August 11	do	92	347	3.60	1,630
September 29	do	89	304	3.10	1,210
1908.					
March 11	E. A. Porter	82	262	2.70	874
April 3	do	85	278	2.90	924
April 24	La Rue and Porter	86	298	3.00	1,120
June 3	E. A. Porter	82	276	2.80	915
July 10	M. B. Kennedy	79	222	2.30	438
July 22	E. A. Porter	81	216	2.40	604
October 7	do	78	184	2.10	404

Daily gage height, in feet, of Truckee River at Nevada-California state line, for 1907 and 1908.

[W. E. Chubbuck, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.65	2.9	3.1	4.2	5.6	6.15	5.25	4.05	3.4	3.2	3.1	2.8
2	2.65	3.7	3.1	4.3	5.7	6.15	5.1	3.95	3.4	3.3	3.1	2.8
3	2.7	3.8	3.1	4.3	5.7	6.05	5.25	3.95	3.4	3.2	3.1	2.8
4	2.7	3.95	3.1	4.2	5.55	6.05	5.4	3.85	3.45	2.45	3.1	2.8
5	2.7	4.05	3.15	4.2	5.15	5.9	5.05	3.85	3.4	3.2	3.0	2.9
6	2.7	3.8	3.15	4.0	5.1	5.75	5.0	3.8	3.4	2.4	3.0	3.0
7	2.6	3.7	3.1	4.1	5.2	5.55	4.95	3.8	3.4	2.4	2.75	3.0
8	2.65	3.4	3.1	4.2	5.15	5.25	4.8	3.75	3.4	2.4	2.7	2.9
9	2.65	3.35	3.1	4.3	5.3	5.25	4.8	3.7	3.4	3.1	2.9	2.9
10	2.7	3.3	3.1	4.9	5.6	5.25	4.75	3.65	3.4	3.25	3.0	2.9
11	2.7	3.25	3.0	5.2	6.0	5.45	4.75	3.6	3.4	3.0	3.0	3.0
12	2.65	3.25	3.1	5.5	5.7	5.5	4.75	3.6	3.4	3.2	3.0	3.0
13	2.7	3.25	3.05	6.15	5.15	4.95	4.55	3.55	3.4	3.2	3.0	3.0
14	2.7	3.25	3.0	7.0	5.0	4.8	4.5	3.5	3.35	3.2	3.0	3.0
15	2.7	3.25	3.05	5.9	5.2	4.65	4.5	3.6	3.3	3.2	2.95	3.0
16	2.7	3.25	3.1	5.5	5.45	4.5	4.45	3.6	3.3	3.2	3.0	2.9
17	2.65	3.2	5.35	5.65	5.65	4.45	4.4	3.55	3.3	3.2	3.0	2.9
18	2.65	3.2	11.5	5.8	5.9	4.55	4.4	3.5	3.3	3.15	2.9	2.9
19	2.6	3.2	8.1	6.0	6.3	4.7	4.4	3.5	3.3	3.15	2.8	2.8
20	2.65	3.15	7.3	6.0	6.15	5.0	4.4	3.5	3.3	3.15	2.8	2.8
21	2.6	3.2	6.25	5.8	5.75	5.0	4.25	3.5	3.3	3.15	2.9	2.8
22	2.65	3.3	5.85	5.85	5.55	5.2	4.15	3.5	3.3	3.15	2.9	2.75
23	2.65	3.25	4.75	6.15	5.2	5.15	4.2	3.45	3.3	3.15	2.9	2.7
24	2.6	3.25	4.3	6.3	5.2	4.9	4.15	3.4	3.3	3.2	2.9	2.8
25	2.6	3.25	4.25	6.2	5.2	4.75	4.1	3.4	3.3	3.2	2.9	2.8
26	2.6	3.2	4.2	6.15	5.2	4.8	4.1	3.4	3.3	3.15	2.9	2.9
27	2.7	3.2	4.05	6.1	5.3	5.0	4.2	3.65	3.3	3.25	2.9	3.25
28	2.9	3.2	4.0	6.0	5.45	5.25	4.2	3.4	3.25	3.2	2.9	3.1
29	2.85	.....	4.0	5.85	5.6	5.15	4.2	3.4	3.2	3.15	2.9	2.8
30	2.85	.....	4.0	5.65	5.75	5.15	4.15	3.4	3.2	3.1	2.85	2.8
31	2.85	.....	4.1	.....	6.05	.....	4.1	3.4	.....	3.1	.....	2.75
1908.												
1	2.8	2.9	2.8	2.9	3.4	2.85	2.4	2.4	2.2	2.15	2.05	2.05
2	2.8	2.8	2.8	2.9	3.45	2.8	2.3	2.4	2.2	2.1	2.1	2.05
3	2.8	3.0	2.8	2.9	3.1	2.7	2.25	2.6	2.2	2.1	2.1	2.1
4	2.8	2.8	2.8	3.05	2.95	2.65	2.2	2.2	2.15	2.2	2.0	2.1
5	2.8	2.8	2.8	3.15	2.9	2.75	2.3	2.2	2.1	2.05	2.0	2.1
6	2.8	2.8	2.75	3.25	3.0	2.8	2.2	2.2	2.0	2.05	2.0	2.1
7	2.8	2.8	2.7	3.05	3.2	2.9	2.2	2.4	2.2	2.1	2.05	2.05
8	2.8	2.8	2.7	2.8	2.95	3.05	2.3	2.4	2.2	2.2	2.1	2.1
9	2.85	2.8	2.8	2.95	2.8	3.05	2.35	2.4	2.2	2.2	2.1	2.0
10	2.85	2.8	2.8	3.1	2.8	3.1	2.3	2.4	2.15	2.2	2.1	1.9
11	2.9	2.8	2.7	3.35	2.8	3.05	2.35	2.35	2.2	2.15	2.1	1.95
12	2.9	2.8	2.7	3.55	2.8	2.95	2.4	2.4	2.2	2.15	2.05	1.95
13	2.85	2.75	2.8	3.65	2.65	3.1	2.35	2.4	2.2	2.2	2.0	2.05
14	3.0	2.7	2.9	3.7	2.65	3.15	2.3	2.3	2.2	2.2	2.0	2.1
15	2.9	2.7	3.0	3.6	2.7	2.95	2.25	2.4	2.2	2.5	2.05	1.95
16	2.9	2.7	3.1	3.45	2.65	2.9	2.15	2.4	2.25	2.45	2.0	2.0
17	2.9	2.8	3.15	3.2	2.65	2.85	2.2	2.35	2.2	2.3	2.05	2.0
18	2.9	2.7	3.25	3.25	2.6	2.75	2.2	2.3	2.25	2.25	2.0	2.0
19	2.9	2.7	3.2	3.4	2.75	2.6	2.15	2.3	2.2	2.2	2.0	2.0
20	2.9	2.7	3.25	3.6	2.65	2.6	2.25	2.3	2.15	2.15	2.1	2.0
21	3.0	2.7	3.35	3.8	2.65	2.7	2.15	2.3	2.15	2.15	2.15	2.0
22	2.9	2.7	3.2	3.45	2.7	2.45	2.45	2.3	2.1	2.1	2.2	2.0
23	2.9	2.7	3.2	3.25	2.75	2.4	2.45	2.25	2.1	2.1	2.2	2.0
24	2.9	2.7	3.35	3.05	2.9	2.55	2.4	2.3	2.15	2.05	2.1	1.95
25	2.9	2.7	3.5	3.05	3.05	2.6	2.4	2.3	2.1	2.1	2.1	1.95
26	2.9	2.75	3.3	3.05	3.1	2.6	2.45	2.3	2.1	2.05	2.05	2.0
27	2.9	2.8	3.25	3.15	2.95	2.5	2.4	2.2	2.1	2.05	2.05	2.0
28	2.9	2.8	3.15	3.25	2.9	2.4	2.4	2.15	2.1	2.15	2.05	2.05
29	2.9	2.8	3.0	3.35	3.1	2.4	2.45	2.15	2.2	2.05	2.05	2.0
30	2.9	.....	3.1	3.4	3.05	2.45	2.4	2.25	2.15	1.95	2.1	2.05
31	2.9	.....	2.95	.....	3.0	.....	2.65	.....	.....	2.1	.....	2.1

Rating tables for Truckee River at Nevada-California state line.

APRIL 16, 1906, TO MARCH 16, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	645	3.00	920	3.40	1,240	3.80	1,605
2.70	710	3.10	995	3.50	1,325	3.90	1,700
2.80	780	3.20	1,075	3.60	1,415	4.00	1,800
2.90	850	3.30	1,155	3.70	1,510	4.10	1,900

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the previous curve, and is fairly well defined above gage height 3.0 feet.

MARCH 17, 1907, TO MAY 31, 1908.

1.70	300	3.10	1,213	4.50	2,620	6.80	6,060
1.80	346	3.20	1,302	4.60	2,740	7.00	6,420
1.90	394	3.30	1,393	4.70	2,860	7.20	6,780
2.00	444	3.40	1,486	4.80	2,990	7.40	7,160
2.10	496	3.50	1,580	4.90	3,120	7.60	7,540
2.20	551	3.60	1,676	5.00	3,250	7.80	7,920
2.30	610	3.70	1,772	5.20	3,530	8.00	8,300
2.40	673	3.80	1,870	5.40	3,810	9.00	10,300
2.50	740	3.90	1,970	5.60	4,100	10.00	12,300
2.60	810	4.00	2,070	5.80	4,400	11.00	14,300
2.70	884	4.10	2,180	6.00	4,720	12.00	16,300
2.80	961	4.20	2,290	6.20	5,040		
2.90	1,042	4.30	2,400	6.40	5,380		
3.00	1,126	4.40	2,510	6.60	5,720		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1903 to 1908, and is well defined between gage heights 1.9 feet and 5.0 feet. Above gage height 5.0 feet the rating table is only approximate.

JUNE 1 TO DECEMBER 31, 1908.

1.90	310	2.20	470	2.50	670	2.80	920
2.00	360	2.30	530	2.60	750	2.90	1,020
2.10	410	2.40	600	2.70	830	3.00	1,126

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during the period and on earlier high-water measurements, and is fairly well defined above gage height 2.1 feet. Above gage height 3.0 feet it is the same as the previous table.

Monthly discharge of Truckee River at Nevada-California state line, for 1907 and 1908.

[Drainage area, 955 square miles.]

Month	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	850	645	702	0.735	0.85	43,200	B.
February	1,850	850	1,220	1.28	1.33	67,800	B.
March	15,300	920	2,590	2.71	3.12	159,000	C.
April	6,420	2,070	3,880	4.06	4.53	231,000	B.
May	5,210	3,250	3,980	4.17	4.81	245,000	B.
June	4,960	2,560	3,570	3.74	4.17	212,000	A.
July	3,810	2,180	2,720	2.85	3.29	167,000	A.
August	2,120	1,490	1,680	1.76	2.03	103,000	A.
September	1,530	1,300	1,430	1.50	1.67	85,100	A.
October	1,390	673	1,200	1.26	1.45	73,800	A.
November	1,210	884	1,080	1.13	1.26	64,300	A.
December	1,350	884	1,040	1.09	1.26	64,000	B.
The year	15,300	645	2,090	2.19	29.77	1,520,000	

Monthly discharge of Truckee River at Nevada-California state line, for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,130	961	1,020	1.07	1.23	62,700	B
February	1,130	884	938	.982	1.06	54,000	B.
March	1,580	884	1,140	1.19	1.37	70,100	B.
April	1,870	961	1,360	1.42	1.58	80,900	B.
May	1,530	810	1,040	1.09	1.26	64,000	B.
June	1,260	600	893	.935	1.04	53,100	B.
July	790	440	550	.576	.66	33,800	B.
August	750	440	544	.570	.66	33,400	B.
September	500	360	448	.469	.52	26,700	B.
October	670	335	445	.466	.54	27,400	B.
November	470	360	394	.413	.46	23,400	B.
December	410	310	370	.387	.45	22,800	B.
The year	1,870	310	762	.797	10.83	552,000	

NOTE.—The open channel rating has been applied throughout the year; values for the winter period are liable to be somewhat too large on account of ice.

TRUCKEE RIVER AT VISTA, NEV.

This station, which is located 7 miles east of Reno and one-fourth mile from Vista railroad station, was established August 18, 1899, to determine the amount of water available below the Truckee Valley for use of the main canal of the Truckee-Carson project, which takes water from the river about 16 miles below.

The gage has been washed out, replaced, and moved several times. The gage used April 16 to December 31, 1907, has no determined relation to previous gages, as it was in a different location. Measurements in 1907 were made at a cable below the railroad bridge where the gage was located, and were referred to a gage at the cable as well as to the regular gage.

Discharge measurements of Truckee River at Vista, Nev., in 1907.

Date.	Hydrographer.	Width.	Area of action.	Gage height.		Discharge.
				At bridge.[a]	At cable.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
May 11	La Rue and Porter	125	910	10.50	9.40	4,640
June 19	E. A. Porter	121	772	9.00	8.10	2,960
July 17	do	120	725	9.00	7.85	2,790
August 10	do	120	542	7.80	6.90	1,530

[a] Observer's readings for the day.

Daily gage height, in feet, of Truckee River at Vista, Nev., for 1907.

[P. Fay, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	5.3	6.6	5.9	.....	10.8	10.8	9.8	8.3	7.5	7.4	7.6	7.1
2	5.3	6.6	5.9	.....	10.7	11.0	9.7	8.1	7.6	7.5	7.5	7.0
3	5.3	6.3	5.9	.....	10.6	11.0	9.7	8.0	7.6	7.5	7.5	7.0
4	5.3	6.3	5.9	.....	10.5	11.0	10.0	8.0	7.7	7.2	7.4	7.0
5	5.3	7.0	6.0	.....	10.2	11.0	9.9	8.0	7.7	7.3	7.4	7.0
6	5.2	7.6	6.0	.....	9.8	10.8	9.7	8.0	7.7	7.3	7.4	7.1
7	5.2	6.9	6.0	.....	9.7	10.6	9.5	8.0	7.6	7.7	7.2	7.3
8	5.2	6.4	5.9	.....	9.6	10.3	9.4	7.9	7.5	7.6	7.1	7.3
9	5.2	6.4	5.9	.....	10.0	11.0	9.2	7.8	7.5	7.0	7.3	7.1
10	5.3	6.2	6.0	.....	10.2	11.0	9.2	7.8	7.5	7.3	7.4	7.1
11	5.2	6.2	6.0	.....	10.5	10.8	9.1	7.8	7.4	7.2	7.4	7.3
12	5.2	6.2	5.9	.....	10.5	10.6	9.1	7.8	7.4	7.2	7.3	7.3
13	5.2	6.2	5.8	.....	10.2	10.3	9.0	7.5	7.3	7.3	7.3	7.3
14	5.2	6.2	5.8	.....	9.9	10.0	8.9	7.5	7.3	7.4	7.3	7.3
15	4.9	6.1	5.8	.....	9.9	9.6	8.9	7.5	7.3	7.4	7.2	7.3
16	5.5	6.1	5.8	.....	9.9	9.3	8.9	7.5	7.3	7.3	7.2	7.2
17	5.5	6.0	5.9	11.9	10.2	9.1	9.0	7.5	7.3	7.4	7.2	7.1
18	5.5	6.0	.....	11.4	10.5	9.0	9.0	7.5	7.3	7.4	7.3	7.1
19	5.5	6.0	.....	11.4	11.0	9.0	8.7	7.4	7.3	7.5	7.2	7.1
20	5.4	6.0	.....	11.5	10.8	9.3	8.8	7.4	7.3	7.4	7.2	7.1
21	5.4	6.1	.....	11.0	10.5	9.4	8.6	7.4	7.3	7.4	7.1	7.0
22	5.4	6.2	.....	10.8	10.4	9.9	8.6	7.4	7.2	7.5	7.1	7.0
23	5.4	6.1	.....	11.0	10.1	9.7	8.5	7.4	7.2	7.4	7.1	7.0
24	5.3	6.2	.....	11.4	10.0	9.5	8.5	7.4	7.2	7.4	7.1	7.0
25	5.2	6.2	.....	11.6	10.0	9.3	8.5	7.4	7.2	7.5	7.1	7.1
26	5.2	6.1	.....	11.5	10.0	9.4	8.5	7.4	7.2	7.6	7.1	7.2
27	5.2	6.0	.....	11.5	10.0	9.5	8.5	7.5	7.2	7.8	7.0	7.3
28	6.0	5.9	.....	11.4	10.0	9.6	8.5	7.6	7.2	8.0	7.0	7.5
29	6.7	.....	.....	11.1	10.1	9.8	8.6	7.5	7.2	7.7	7.0	7.5
30	5.5	.....	.....	11.0	10.3	9.8	8.5	7.4	7.2	7.6	7.0	7.1
31	6.8	.....	.....	.....	10.5	.....	8.3	7.5	.....	7.6	.....	7.1

NOTE.—The gage was washed out March 19, 1907. On April 17 the observer recommenced readings by measuring from the top of the west abutment of the railroad bridge. The gage heights after that are referred to this point, assumed elevation 20.0 feet. Readings for August to December are somewhat uncertain, but comparisons with records at the Derby dam station tend to confirm them.

Rating tables for Truckee River at Vista, Nev.

JANUARY 1 TO MARCH 17, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.90	775	5.70	1,220	6.50	1,755	7.30	2,440
5.00	825	5.80	1,280	6.60	1,830	7.40	2,540
5.10	875	5.90	1,345	6.70	1,910	7.50	2,640
5.20	930	6.00	1,410	6.80	1,990	7.60	2,740
5.30	985	6.10	1,475	6.90	2,080	7.70	2,840
5.40	1,040	6.20	1,540	7.00	2,170		
5.50	1,100	6.30	1,610	7.10	2,260		
5.60	1,160	6.40	1,680	7.20	2,350		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904–1906, and is well defined below gage height 8.0 feet.

Rating tables for Truckee River at Vista, Nev.—Continued.

APRIL 17 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.00	980	8.20	1,980	9.40	3,290	10.60	4,790
7.10	1,050	8.30	2,080	9.50	3,410	10.70	4,920
7.20	1,120	8.40	2,180	9.60	3,530	10.80	5,050
7.30	1,190	8.50	2,280	9.70	3,650	10.90	5,180
7.40	1,260	8.60	2,380	9.80	3,770	11.00	5,310
7.50	1,340	8.70	2,490	9.90	3,890	11.20	5,580
7.60	1,420	8.80	2,600	10.00	4,010	11.40	5,860
7.70	1,510	8.90	2,710	10.10	4,140	11.60	6,140
7.80	1,600	9.00	2,820	10.20	4,270	11.80	6,420
7.90	1,690	9.10	2,930	10.30	4,400	12.00	6,700
8.00	1,780	9.20	3,050	10.40	4,530		
8.10	1,880	9.30	3,170	10.50	4,660		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908, and is fairly well defined above gage height 7.8 feet.

Monthly discharge of Truckee River at Vista, Nev., for 1907.

[Drainage area, 1,520 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	1,990	775	1,060	0.697	0.80	65,200	B.
February	2,740	1,340	1,620	1.07	1.11	90,000	B.
March 1–17	1,410	1,280	1,350	.888	.56	45,500	B.
April 17–30	6,560	5,050	5,750	3.78	1.97	160,000	A.
May	5,310	3,530	4,320	2.84	3.27	266,000	A.
June	5,310	2,820	4,100	2.70	3.01	244,000	A.
July	4,010	2,080	2,840	1.87	2.16	175,000	A.
August	2,080	1,260	1,480	.974	1.12	91,000	A.
September	1,510	1,120	1,250	.822	.92	74,400	A.
October	1,780	980	1,300	.855	.99	79,900	A.
November	1,420	980	1,140	.750	.84	67,800	B.
December	1,340	980	1,090	.717	.83	67,000	B.
The period						1,430,000	

NOTE.—Open-channel rating applied throughout the year; discharges for winter months may be somewhat too large on account of ice.

TRUCKEE RIVER AT DERBY DAM, NEV.

This station, which is located about 2 miles east of Clarks, Nev., three-fourths mile above the Reclamation Service diversion dam for the main canal of the Truckee-Carson project (see Pl. VI), was established July 1, 1907, to determine the amount of water available for the canal and the amount in excess of the requirements of the water users in the Wadsworth Valley. This station replaces the station at Vista, giving practically the same record. Results obtained at this station are good.

DIVERSION DAM ON TRUCKEE RIVER, TRUCKEE-CARSON PROJECT, NEVADA.

Discharge measurements of Truckee River at Derby dam, Nev., in 1908 and 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 4	E. A. Porter	102	241	5.05	911
March 19	do	116	346	5.75	1,430
April 4	do	106	276	5.40	1,040
April 23	La Rue and Porter	102	266	5.30	1,000
May 5	E. A. Porter	98	223	4.95	764
May 29	do	96	202	4.65	679
July 3	do	90	112	3.67	246
July 20	do	90	96	3.52	187
October 6	do	94	136	4.00	397
1909.					
January 20	E. A. Porter		762	9.2	4,030
January 21	do		908	10.2	4,900
January 28	do		371	6.2	1,660

Daily gage height, in feet, of Truckee River at Derby dam, Nev., for 1907 and 1908.

[Roy Harling, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]							1907.[a]						
1	8.5	6.6	6.1	5.7	5.7	4.45	16	7.5	5.7	5.6	5.4	4.9	4.5
2	8.4	6.4	6.1	5.75	5.6	4.45	17	7.4	5.7	5.55	5.4	4.4	5.15
3	8.5	6.4	6.1	5.75	5.4	4.4	18	7.3	5.7	5.6	5.45	4.4	5.15
4	8.7	6.35	6.1	5.65	5.4	4.4	19	7.3	5.7	5.6	5.45	4.5	5.2
5	8.6	6.35	6.1	5.8	5.4	4.5	20	7.3	5.8	5.6	5.45	4.5	5.2
6	8.3	6.3	6.0	5.45	5.5	4.5	21	7.2	5.8	5.65	5.45	4.5	5.0
7	8.25	6.3	6.0	4.85	5.5	4.5	22	7.05	5.8	5.6	5.4	4.5	5.0
8	8.2	6.2	5.9	4.9	5.3	4.45	23	6.85	5.7	5.6	5.45	4.6	5.0
9	8.0	6.05	5.85	5.0	5.3	4.5	24	6.85	5.7	5.6	5.45	4.5	4.9
10	8.2	6.0	5.7	5.6	5.1	5.15	25	6.85	5.75	5.7	5.5	4.45	4.8
11	8.0	5.95	5.6	5.5	4.8	5.15	26	6.85	5.8	5.6	6.1	4.45	5.0
12	8.0	5.9	5.6	5.4	4.8	5.2	27	6.85	5.9	5.6	6.3	4.5	5.2
13	7.9	5.8	5.6	5.4	4.85	5.2	28	6.2	6.2	5.6	6.4	4.5	5.4
14	7.8	5.8	5.65	5.4	4.85	5.0	29	6.95	5.6	5.6	6.4	4.5	.....
15	7.7	5.75	5.65	5.4	4.85	4.45	30	6.85	5.65	5.6	6.1	4.45	.....
							31	6.7	5.7	.....	5.7	.....	.....

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5.8	5.1	5.0	5.4	5.2	4.7	3.8	5.1	3.7	3.9	4.1	3.9
2	5.8	5.2	5.0	5.3	5.25	4.45	3.7	.....	3.6	3.85	4.15	4.0
3	5.6	5.1	5.0	5.3	5.1	4.35	3.65	4.6	3.6	3.9	4.1	4.05
4	5.5	5.1	5.0	5.4	4.95	4.4	3.65	4.4	3.6	4.0	4.0	4.1
5	5.5	5.1	5.0	5.55	4.75	4.35	3.6	3.8	3.6	4.1	3.9	4.15
6	5.3	5.1	5.0	5.75	4.7	4.4	3.5	3.5	3.65	4.0	3.9	4.1
7	5.2	5.15	5.0	5.55	4.85	4.6	3.5	3.4	3.5	3.95	4.0	4.05
8	5.6	5.2	5.0	5.4	4.8	4.8	3.4	3.85	3.6	3.9	4.0	4.0
9	5.6	5.1	5.0	5.35	4.7	4.9	3.7	3.85	3.65	4.0	4.05	4.0
10	5.65	5.05	5.0	5.45	4.6	4.8	4.3	3.9	3.65	3.95	4.05	4.0
11	5.65	5.05	5.0	5.6	4.45	4.75	3.65	3.75	3.7	3.95	4.0	3.9
12	5.65	5.05	5.0	6.1	4.65	4.7	3.65	3.7	3.7	4.0	4.0	3.9
13	5.5	4.9	5.05	6.0	4.65	5.0	3.85	3.65	3.7	4.0	4.0	4.0
14	5.4	4.9	5.2	6.0	4.6	5.5	4.5	3.85	3.7	4.1	4.0	4.0
15	5.35	4.9	5.35	6.05	4.45	5.1	3.9	3.95	3.75	4.2	4.0	4.0
16	5.2	4.9	5.45	5.65	4.45	4.9	3.8	3.85	3.8	4.7	3.9	3.95
17	5.15	5.0	5.55	5.35	4.35	4.7	3.65	3.75	3.95	4.35	4.0	3.9
18	5.15	4.9	5.65	5.3	4.35	4.5	3.6	3.7	4.0	4.25	3.95	3.9
19	5.15	4.9	5.75	5.6	4.35	4.4	3.6	3.65	4.0	4.2	3.95	3.9
20	5.2	4.9	5.75	5.8	4.4	4.3	3.5	3.6	3.9	4.2	4.0	3.95

[a] Gage heights for November and December and possibly for other periods were read from a temporary gage set by the observer and are somewhat uncertain.

Daily gage height, in feet, of Truckee River at Derby dam, Nev., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
21	5.2	5.0	5.75	6.1	4.35	4.4	3.4	3.7	3.85	4.15	4.1	4.0
22	5.4	5.0	5.75	5.9	4.35	4.3	3.3	3.6	3.8	4.15	4.15	4.0
23	5.4	4.9	5.75	5.3	4.3	4.3	3.85	3.6	3.75	4.1	4.1	4.05
24	5.4	4.9	5.9	5.0	4.3	4.2	4.05	3.65	3.75	4.1	4.1	4.05
25	5.3	4.9	6.0	4.9	4.7	4.15	3.95	3.7	3.75	4.1	4.05	4.0
26	5.2	4.9	6.2	4.8	4.8	4.15	3.9	3.65	3.8	4.1	4.0	4.0
27	5.3	4.9	6.0	4.85	4.85	4.1	4.0	3.65	3.85	4.05	4.0	4.0
28	5.3	5.0	5.8	5.0	4.65	3.75	3.95	3.65	3.85	4.05	4.0	4.0
29	5.2	5.05	5.5	5.05	4.65	3.75	4.4	3.6	3.8	4.0	4.0	4.0
30	5.1	.....	5.5	5.15	4.9	3.9	4.55	3.6	3.85	4.0	3.9	3.95
31	5.1	.....	5.5	.....	4.8	.....	5.2	3.6	.....	4.0	.....	3.95

Rating table for Truckee River at Derby dam, Nev., for July 1, 1907, to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec. ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	120	4.50	600	5.70	1,280	6.90	2,150
3.40	150	4.60	650	5.80	1,345	7.00	2,230
3.50	180	4.70	700	5.90	1,410	7.20	2,390
3.60	215	4.80	750	6.00	1,480	7.40	2,550
3.70	250	4.90	800	6.10	1,550	7.60	2,710
3.80	290	5.00	855	6.20	1,625	7.80	2,870
3.90	330	5.10	910	6.30	1,700	8.00	3,030
4.00	370	5.20	970	6.40	1,775	8.20	3,190
4.10	415	5.30	1,030	6.50	1,850	8.40	3,360
4.20	460	5.40	1,090	6.60	1,925	8.60	3,530
4.30	505	5.50	1,150	6.70	2,000	8.80	3,700
4.40	550	5.60	1,215	6.80	2,075		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1908–9, and is well defined between gage heights 3.5 feet and 10.3 feet.

Monthly discharge of Truckee River at Derby dam, Nev., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
July	3,620	1,620	2,700	166,000	A.
August	1,920	1,220	1,450	89,200	A.
September	1,550	1,180	1,310	78,000	A.
October	1,780	775	1,210	74,400	A.
November	1,280	550	798	47,500	B.
December	1,280	550	825	50,700	C.
The period	.....	.....	.....	506,000	
1908.					
January	1,340	910	1,080	66,400	B.
February	970	800	858	49,400	B.
March	1,620	855	1,100	67,600	A.
April	1,550	750	1,140	67,800	A.
May	1,000	505	679	41,800	A.
June	1,150	270	602	35,800	A.
July	970	120	317	19,500	A.
August	910	150	310	19,100	A.
September	370	180	270	16,100	A.
October	700	310	405	24,900	A.
November	438	330	378	22,500	A.
December	438	330	368	22,600	B.
The year	1,620	120	626	454,000	

DONNER CREEK NEAR TRUCKEE, CAL.

Donner Creek flows from the east end of Donner Lake eastward into Truckee River about 1½ miles above Truckee, Cal., its length being about 2 miles.

The gaging station, which was established October 23, 1902, to determine the amount of water available for storage in Donner Lake for use on the Truckee-Carson project, is located 150 feet below the dam of the Donner Creek Ice Company and 1½ miles west of Truckee, Cal., and below the mouth of Cold Creek, the principal tributary.

The record is considered reliable. It is probably not greatly affected by ice, but it is affected by the raising and lowering of the gates of the storage dam at the outlet of Donner Lake.

Discharge measurements of Donner Creek near Truckee, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 22	Nicholas and Porter	40	111	3.90	384
June 28	E. A. Porter	40	85	3.25	218
July 26	do	36	56	2.40	84
August 13	do	36	39	2.00	30
1908.					
May 12	E. A. Porter	38	70	2.70	138
July 7	M. B. Kennedy	38	59	2.15	58
October 16	E. A. Porter			1.20	[a] 3.4

[a] Discharge estimated.

Daily gage height, in feet, of Donner Creek near Truckee, Cal., for 1907 and 1908.

[W. O. Blinn, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.3	1.75	2.05	3.55	3.75	4.4	3.8	2.25	2.2	1.7	1.4	1.2
2	1.3	2.5	2.3	3.5	3.8	4.6	3.75	2.2	2.2	1.6	1.4	1.2
3	1.3	2.85	2.1	3.6	3.8	4.55	3.8	2.2	2.15	1.6	1.4	1.2
4	1.25	2.75	2.1	3.6	3.65	4.6	3.7	2.15	2.1	1.6	1.4	1.25
5	1.2	2.7	2.1	3.4	3.6	4.3	3.55	2.15	2.1	1.6	1.9	1.3
6	1.2	2.6	2.2	3.25	3.55	4.25	3.45	2.1	2.1	1.6	1.8	1.35
7	1.2	2.45	2.5	3.2	3.6	4.1	3.25	2.1	2.1	1.6	1.7	1.45
8	1.25	2.4	2.4	3.15	3.6	3.9	3.25	2.1	2.1	1.6	1.45	1.5
9	1.35	2.3	2.3	3.15	3.7	3.85	3.1	2.05	2.0	1.6	1.3	1.5
10	1.4	2.25	2.5	3.25	3.95	4.0	3.1	2.0	2.0	1.6	1.3	1.7
11	1.45	2.2	2.4	3.3	4.05	4.25	3.15	2.0	2.0	1.6	1.3	1.2
12	1.5	2.1	2.2	3.4	3.9	3.85	2.95	2.0	2.0	1.6	1.55	1.2
13	1.6	2.1	2.0	3.55	3.75	3.65	2.8	2.0	2.0	1.6	1.7	1.6
14	1.65	2.1	1.85	3.7	3.65	3.55	2.75	2.0	2.0	1.6	1.5	1.5
15	1.75	2.1	2.05	3.65	3.65	3.45	2.7	2.0	2.0	1.6	1.4	1.5
16	1.7	2.1	2.1	3.5	3.75	3.3	2.7	2.0	1.9	1.6	1.4	1.5
17	1.75	2.1	3.25	3.55	3.8	3.2	2.75	2.0	1.85	1.6	1.4	1.45
18	1.75	2.1	5.5	3.6	4.95	3.3	2.75	2.1	1.8	1.6	1.3	1.45
19	1.7	2.1	4.8	3.6	4.5	3.4	2.65	2.1	1.8	1.6	1.35	1.4
20	1.7	2.1	4.6	3.7	4.35	3.45	2.65	2.1	1.8	1.6	1.35	1.3
21	1.7	2.15	4.2	3.65	4.0	3.4	2.55	2.1	1.7	1.6	1.3	1.35
22	1.6	2.2	3.95	3.7	4.15	3.5	2.45	2.1	1.7	1.3	1.35	1.5
23	1.6	2.1	3.75	3.8	3.75	3.4	2.4	2.05	1.7	1.3	1.6	1.5
24	1.6	2.1	3.35	3.8	3.85	3.35	2.4	2.0	1.7	1.3	1.6	1.45
25	1.65	2.2	3.55	3.85	3.85	3.2	2.45	2.0	1.7	1.3	1.6	1.45
26	1.65	2.2	3.55	3.85	3.75	3.1	2.35	2.0	1.7	1.3	1.2	1.9
27	1.6	2.1	3.2	3.85	3.8	3.15	2.35	2.0	1.7	1.3	1.2	1.9
28	1.75	2.1	3.15	3.8	4.0	3.4	2.4	2.0	1.7	1.3	1.2	1.8
29	1.75	.....	3.4	3.8	4.1	3.65	2.4	2.0	1.7	1.4	1.2	1.75
30	1.65	.....	3.8	3.75	4.15	3.8	2.35	2.15	1.7	1.4	1.2	1.55
31	1.6	.....	3.95	.....	4.3	.....	2.3	2.2	.....	1.4	.....	1.35

Daily gage height, in feet, of Donner Creek near Truckee, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	1.45	1.95	1.8	2.3	3.15	2.8	2.3	1.6	1.3	1.3	1.2	1.3
2	1.4	1.9	1.9	2.3	3.05	2.75	2.3	1.6	1.3	1.3	1.2	1.4
3	1.45	2.0	1.85	2.3	2.95	2.65	2.3	1.6	1.7	1.3	1.2	1.4
4	1.35	1.95	1.9	2.3	3.05	2.7	2.3	1.55	1.55	1.3	1.2	1.3
5	1.5	2.0	1.9	2.4	2.9	2.7	2.3	1.5	1.35	1.3	1.2	1.4
6	1.45	1.95	1.9	2.4	2.8	2.7	2.2	1.5	1.3	1.3	1.2	1.4
7	1.7	2.0	1.85	2.5	2.75	2.7	2.15	1.5	1.3	1.2	1.2	1.3
8	1.7	1.95	1.8	2.5	3.05	2.85	2.1	1.5	1.3	1.1	1.2	1.3
9	1.6	1.9	1.85	2.55	2.85	2.85	2.1	1.5	1.3	1.1	1.2	1.4
10	1.6	1.85	1.9	2.6	2.85	2.85	2.1	1.45	1.3	1.1	1.2	1.3
11	2.0	1.9	1.9	2.8	2.65	2.8	2.05	1.4	1.3	1.1	1.2	1.35
12	2.0	1.75	1.9	2.8	2.75	2.8	2.05	1.4	1.3	1.1	1.2	1.35
13	1.95	1.85	1.9	3.1	2.65	2.9	2.0	1.4	1.3	1.1	1.2	1.3
14	1.9	1.9	1.9	3.0	2.7	2.85	2.0	1.4	1.3	1.1	1.2	1.3
15	1.85	1.8	2.0	3.0	2.7	2.8	2.0	1.4	1.3	1.15	1.2	1.3
16	1.7	1.75	2.0	2.95	2.65	2.75	1.9	1.3	1.3	1.2	1.2	1.3
17	1.75	1.75	2.15	2.9	2.6	2.7	1.9	1.3	1.3	1.15	1.2	1.3
18	1.8	1.85	2.2	2.9	2.7	2.65	1.9	1.3	1.3	1.1	1.2	1.55
19	1.6	1.8	2.2	2.9	2.7	2.6	1.85	1.3	1.3	1.1	1.2	1.8
20	1.6	1.8	2.2	3.25	2.65	2.55	1.8	1.3	1.3	1.1	1.2	1.7
21	1.75	1.7	2.25	3.2	2.6	2.65	1.8	1.3	1.3	1.1	1.3	1.7
22	1.8	1.75	2.25	3.0	2.65	2.35	1.75	1.4	1.3	1.1	1.5	1.7
23	1.9	1.85	2.25	2.95	2.8	2.45	1.7	1.3	1.3	1.1	1.6	1.7
24	1.75	1.8	2.3	2.9	2.9	2.55	1.7	1.3	1.3	1.1	1.6	1.7
25	1.8	1.8	2.3	2.85	3.05	2.55	1.6	1.3	1.3	1.1	1.5	1.7
26	1.85	1.8	2.3	2.9	2.95	2.5	1.65	1.3	1.3	1.1	1.3	1.7
27	1.95	1.7	2.3	3.0	3.0	2.4	1.65	1.3	1.3	1.1	1.3	1.7
28	2.05	1.8	2.3	3.05	2.9	2.35	1.65	1.3	1.3	1.1	1.3	1.7
29	2.0	1.85	2.3	3.1	3.0	2.35	1.65	1.3	1.3	1.1	1.3	1.7
30	2.05	.....	2.3	3.15	2.9	2.3	1.65	1.3	1.3	1.1	1.3	1.45
31	2.1	.....	2.3	.....	2.8	.....	1.6	1.3	.....	1.1	.....	1.4

NOTE.—The sudden fluctuations in stage are caused by the raising and lowering of the gates of the dam at the outlet of Donner Lake. The river was frozen January 1 to 17, 1908, and probably at other times.

Rating tables for Donner Creek near Truckee, Cal.

MAY 1, 1906, TO MARCH 17, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	15	1.80	45	2.40	111	3.00	217
1.30	19	1.90	53	2.50	126	3.10	239
1.40	23	2.00	62	2.60	142	3.20	261
1.50	27	2.10	72	2.70	159	3.30	284
1.60	32	2.20	84	2.80	177		
1.70	38	2.30	97	2.90	196		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1906 and the form of the previous curve, and is not well defined.

MARCH 18 TO DECEMBER 31, 1907.

1.20	5	2.30	64	3.40	252	4.50	588
1.30	7	2.40	76	3.50	276	4.60	626
1.40	9	2.50	90	3.60	302	4.70	664
1.50	11	2.60	104	3.70	328	4.80	702
1.60	14	2.70	118	3.80	356	4.90	740
1.70	18	2.80	134	3.90	384	5.00	780
1.80	22	2.90	150	4.00	414	5.20	860
1.90	28	3.00	168	4.10	444	5.40	940
2.00	34	3.10	186	4.20	478	5.60	1,020
2.10	42	3.20	206	4.30	512		
2.20	52	3.30	228	4.40	550		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907, and is not well defined.

Rating tables for Donner Creek near Truckee, Cal.—Continued.

JANUARY 1 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	2	1.70	26	2.30	75	2.90	157
1.20	4	1.80	32	2.40	86	3.00	175
1.30	7	1.90	39	2.50	98	3.10	194
1.40	11	2.00	47	2.60	111	3.20	214
1.50	15	2.10	56	2.70	126	3.30	235
1.60	20	2.20	65	2.80	141		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1907–8, and is fairly well defined between gage heights 1.2 feet and 4.0 feet.

Monthly discharge of Donner Creek near Truckee, Cal., for 1907 and 1908.

[Drainage area, 30 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	42	15	29.9	0.997	1.15	1,840	C.
February	186	42	92.5	3.08	3.21	5,140	C.
March	980	49	239	7.97	9.19	14,700	B.
April	370	196	296	9.87	11.01	17,600	A.
May	760	289	392	13.1	15.10	24,100	A.
June	626	186	349	11.6	12.94	20,800	A.
July	356	64	158	5.27	6.08	9,720	A.
August	58	34	40.1	1.34	1.54	2,470	B.
September	52	18	29.9	.997	1.11	1,780	B.
October	18	7	12.1	.403	.46	744	C.
November	28	5	10.3	.343	.38	613	C.
December	28	5	11.2	.373	.43	689	D.
The year	980	5	138	4.61	62.60	100,000	
1908.							
January	56	9	30.7	1.02	1.18	1,890	C.
February	47	26	35.9	1.20	1.29	2,060	C.
March	75	32	54.3	1.81	2.09	3,340	B.
April	224	75	145	4.83	5.39	8,630	A.
May	204	111	147	4.90	5.65	9,040	A.
June	157	75	120	4.00	4.46	7,140	A.
July	75	20	44.0	1.47	1.70	2,700	A.
August	20	7	10.9	.363	.42	670	B.
September	26	7	8.1	.270	.30	482	B.
October	7	2	3.2	.107	.12	197	C.
November	20	4	6.4	.213	.24	381	C.
December	32	7	15.4	.513	.59	947	C.
The year	224	2	51.7	1.72	23.43	37,500	

NOTE.—The open-channel rating has been applied throughout the year; discharges for the winter period are liable to be too large on account of ice.

PROSSER CREEK NEAR HOBART MILLS, CAL.

This station, which is located just below Alder Creek, about 2 miles above the mouth of Prosser Creek, 4 miles north of Truckee, and 3 miles below Hobart Mills, Cal., was established June 27, 1903, to determine the amount of water available for storage near the headwaters of the stream. It was discontinued October 15, 1904, and reestablished September 23, 1907, some miscellaneous measurements having been made at this point in the meantime.

The section is permanent, but results are considerably affected by ice. No measurements have yet been obtained at extreme low stages.

Discharge measurements of Prosser Creek near Hobart Mills, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 12[a]	E. A. Porter			3.52	114
June 16[a]	do	60	66	3.70	138
July 7[b]	M. B. Kennedy	53	52	3.30	74
October 16[b]	E. A. Porter	54	44	3.10	47

[a] Measured at bridge. [b] Measured at cable.

Daily gage height, in feet, of Prosser Creek near Hobart Mills, Cal., for 1907 and 1908.

[E. A. Curtis, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1907.					1907.				
1		3.0	3.0	3.0	16		3.0	3.0	3.1
2		3.1	3.0	3.0	17		3.0		3.1
3		3.0		3.0	18		3.0	3.0	3.1
4		3.0	3.0	3.1	19		3.0	3.0	3.1
5		3.0	3.0	3.1	20			3.0	3.1
6			3.0	3.1	21		3.0	3.0	3.1
7		3.0	3.0		22		3.0	2.9	
8		3.0	3.0		23	3.0	3.0	2.9	3.1
9		3.0	3.0	3.1	24	3.0	3.1		3.1
10		3.0		3.1	25	3.0	3.1	2.9	3.1
11		3.0	3.0	3.1	26	3.0	3.1	2.9	3.2
12		3.0	3.0	3.1	27	3.0		2.9	3.2
13			3.0	3.1	28	2.9	3.0	2.9	3.1
14		3.0	3.0	3.1	29		3.0	2.9	
15		3.0	3.0		30	2.9	3.0	2.9	3.5
					31		3.0		3.7

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	3.7	3.4		3.8	3.95	3.9	3.45	2.6	2.55	2.9	2.8	3.05
2	3.7		2.9	3.8	3.85	3.8	3.45	2.6	2.65	2.8	2.8	3.0
3	3.7	3.0	2.9	3.8	3.85	3.85	3.55	2.55	2.65	2.85	2.85	2.95
4	2.9	3.0	2.9	4.0	3.8	3.9	3.55	2.55	2.6	2.9	2.8	2.9
5		3.0	2.9		3.75	4.0	3.45	2.6	2.7	2.85	2.8	2.9
6	3.6	3.0	2.8	3.9	3.9	4.0	3.45	2.55	2.65	2.9	2.8	3.0
7	3.5	2.9	2.8	3.8	3.9	4.0	3.35	2.55	2.65	2.9	2.8	3.05
8	3.7	2.9		3.8	3.9	3.95	3.35	2.45	2.6	2.9	2.8	3.2
9	3.7		3.0	3.9	3.85	4.0	3.25	2.45	2.7	2.85	2.8	3.1
10	3.1	3.0	3.5	3.9	3.85	3.9	3.35	2.45	2.7	2.9	2.8	3.0
11	3.9	3.2	3.3	3.9	3.95	3.95	3.35	2.45	2.8	2.9	2.85	3.0
12		3.0	3.2		3.9	4.1	3.55	2.4	2.8	2.9	2.85	3.05
13	3.9	3.0	3.0	3.9	3.75	4.05	3.35	2.45	2.85	2.9	2.8	3.0
14	3.9	3.0	3.0	3.9	3.7	4.0	3.25	2.5	2.85	3.05	2.8	3.0
15	3.7	3.0		4.0	3.8	3.8	3.15	2.45	2.9	3.9	2.85	3.05
16	3.6		3.8	4.0	3.75	3.75	3.05	2.55	2.9	3.25	2.85	3.05
17	3.0	2.8	3.9	4.0	3.9	3.75	2.95	2.55	2.9	3.0	2.85	3.0
18	3.0	2.9	4.0	3.9	3.8	3.75	2.9	2.65	2.9	2.95	2.8	3.0
19		3.0	3.9		3.95	3.6	2.85	2.55	2.9	2.9	2.8	3.0
20	3.0	2.9	3.9	4.0	3.85	3.75	2.95	2.55	2.85	2.9	2.8	3.0
21	3.0	2.9	3.8	4.0	3.85	3.85	2.9	2.55	2.8	2.85	3.05	3.0
22	3.1	3.0		4.0	3.95	3.75	2.85	2.6	2.8	2.85	3.1	3.0
23	3.1		3.7	4.0	3.9	3.65	2.9	2.55	2.85	2.9	3.1	3.0
24	3.3	2.9	3.8	4.0	3.95	3.65	2.85	2.55	2.9	2.9	3.05	3.1
25	3.3	2.9	3.8	3.7	4.0	3.5	2.75	2.55	2.9	2.85	3.0	3.15
26		2.9	3.8		3.9	3.55	2.85	2.6	2.8	2.85	3.0	3.05
27	3.0	2.9	4.0	3.8	3.95	3.55	2.85	2.55	2.85	2.9	3.0	3.05
28	2.9	2.9	4.0	3.8	4.0	3.5	2.8	2.6	2.9	2.85	3.0	3.15
29	3.3	2.7		3.7	3.9	3.5	2.75	2.6	2.8	2.8	3.15	3.15
30	3.4		3.7	3.8	3.75	3.5	2.7	2.6	2.9	2.8	3.1	3.05
31	3.4		3.7		3.85		2.65	2.55		2.8		3.05

NOTE.—Ice conditions December 1 to 31, 1907, January 1 to February 15, and December 24 to 31, 1908.

Rating table for Prosser Creek near Hobart Mills, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	10	2.90	33	3.40	88	3.90	178
2.50	14	3.00	39	3.50	105	4.00	197
2.60	18	3.10	48	3.60	122	4.10	216
2.70	22	3.20	60	3.70	140	4.20	236
2.80	27	3.30	74	3.80	159	4.30	256

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1908–9, and is well defined between gage heights 3.0 feet and 4.0 feet. Below gage height 3.0 feet it is approximated, and discharges based on it are subject to revision.

Monthly discharge of Prosser Creek near Hobart Mills, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September 23–30	39	33	36.8	584	B.
October	48	39	40.3	2,480	B.
November	39	33	37.0	2,200	B.
December	.....	.....	33.0	2,030	D.
The period	.....	.....	.....	7,290	
January	.....	.....	33.0	2,030	D.
February	.....	.....	32.8	1,890	D.
March	197	27	108.0	6,640	A.
April	197	140	176.0	10,500	A.
May	197	140	172.0	10,600	A.
June	216	105	158.0	9,400	A.
July	114	20	58.1	3,570	A.
August	20	10	15.6	959	D.
September	33	16	26.9	1,600	C.
October	178	27	37.9	2,330	B.
November	54	27	33.3	1,980	B.
December	.....	.....	40.3	2,480	D.
The year	216	10	74.3	54,000	

NOTE.—Discharges estimated for ice periods and interpolated on days when gage was not read.

LITTLE TRUCKEE RIVER AT PINE STATION AND STARR, CAL.

Little Truckee River rises on the eastern slope of the Sierra Nevada, in northwestern Nevada County, Cal., flows north, then east, and then south, and unites with the Truckee at the town of Boca, Cal.

The station was established June 25, 1903, to obtain data for the United States Reclamation Service as to the quantity of water available for storage at Independence and Webber lakes and along the course of the stream, and also for power development. (See Pl. V, *A*.) It was originally located at Bruhn's mill, or Pine station, on the Boca and Loyalton Railroad. On January 1, 1908, it was moved 2 miles upstream to Starr, Cal., which is about 5 miles north of Boca, the nearest post-office. The flow is practically the same at both places. The station is below all tributaries except Dry Creek.

Results at Pine station have been poor on account of shifting channel, but the station at Starr promises to give good results. The creek freezes during parts of the winter.

Discharge measurements of Little Truckee River at Pine station, Cal., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 3	E. A. Porter	93	194	3.20	1,010
July 5	do	87	171	2.30	789
July 27	do	82	101	1.70	306
August 21	do	49	62	.95	125

Daily gage height, in feet, of Little Truckee River at Pine station, Cal., for 1907.

[S. Wallace, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.05	1.45	1.35	2.1	3.3	3.35	2.6	1.5	0.8	0.7	0.95	0.7
2	1.05	1.8	1.4	2.15	3.25	3.35	2.45	1.45	.8	.7	.9	.75
3	1.05	1.75	1.35	2.1	3.15	3.3	2.5	1.4	.8	.7	.9	.75
4	.9	1.8	1.35	2.1	3.05	3.3	2.6	1.3	.8	.7	.9	.7
5	1.0	1.85	1.35	2.05	2.85	3.2	2.45	1.3	.85	.7	.85	.7
6	1.25	1.8	1.35	2.05	2.85	3.1	2.4	1.25	.85	.65	.85	.75
7	1.4	1.8	1.3	2.15	2.8	3.05	2.35	1.3	.9	.8	.85	.85
8	1.25	1.7	1.3	2.3	2.8	2.75	2.3	1.25	.9	.8	.8	.95
9	1.55	1.6	1.3	2.5	2.9	2.7	2.25	1.25	.8	.75	.8	1.0
10	1.5	1.5	1.25	2.9	3.15	2.75	2.15	1.2	.8	.75	.75	1.0
11	1.5	1.55	1.25	3.1	3.3	3.25	2.05	1.15	.8	.75	.7	.95
12	1.4	1.55	1.2	3.25	3.1	2.85	2.1	1.1	.75	.7	.7	1.0
13	1.5	1.5	1.35	3.4	2.8	2.6	2.05	1.1	.75	.7	.7	.9
14	1.65	1.5	1.2	3.7	2.7	2.3	2.15	1.05	.7	.7	.7	.8
15	1.65	1.5	1.25	3.55	2.8	2.2	2.05	1.05	.7	.7	.7	1.0
16	1.8	1.5	1.3	3.3	2.95	2.1	2.0	1.0	.7	.7	.7	1.0
17	1.9	1.45	2.35	3.35	3.05	2.1	1.95	1.0	.7	.7	.....	.9
18	1.8	1.45	4.05	3.5	3.15	2.2	1.9	1.0	.7	.7	.....	.95
19	1.75	1.45	3.65	3.6	3.4	2.25	1.95	.95	.7	.7	.....	1.0
20	1.75	1.5	3.4	3.5	3.3	2.35	1.9	.9	.7	.75	.....	1.05
21	1.7	1.5	2.95	3.4	3.0	2.5	1.85	.9	.7	.75	.....	.9
22	1.6	1.55	2.7	3.5	2.95	2.7	1.65	.9	.7	.75	.....	.85
23	1.55	1.5	2.35	3.65	2.75	2.6	1.65	.9	.65	.7	.....	.9
24	1.6	1.5	2.3	3.65	2.7	2.5	1.65	.9	.65	.8	.....	.95
25	1.55	1.55	2.35	3.65	2.75	2.25	1.85	.85	.65	.8	.....	.8
26	1.45	1.5	2.25	3.6	2.75	2.3	1.7	.85	.65	.8	.....	1.0
27	1.4	1.35	2.15	3.55	2.75	2.4	1.75	.85	.65	.9	.....	1.5
28	1.5	1.35	2.1	3.45	2.85	2.65	1.8	.85	.65	.85	.....	1.1
29	1.45	.....	1.95	3.35	2.9	2.55	1.85	.85	.7	.8	.....	.85
30	1.4	.....	1.95	3.3	3.05	2.55	1.75	.8	.7	.9	.....	.95
31	1.4	.....	2.0	.....	3.15	.....	1.6	.8	.....	1.0	.....	.9

NOTE.—The observer made no ice notes; the river was probably frozen during parts of January and December.

Rating tables for Little Truckee River at Pine station, Cal.

JANUARY 1, 1906, TO JUNE 19, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	55	1.60	237	2.50	640	3.40	1,160
.80	67	1.70	271	2.60	695	3.50	1,225
.90	80	1.80	309	2.70	750	3.60	1,290
1.00	94	1.90	351	2.80	805	3.70	1,355
1.10	110	2.00	395	2.90	860		
1.20	129	2.10	440	3.00	920		
1.30	152	2.20	490	3.10	980		
1.40	178	2.30	540	3.20	1,040		
1.50	206	2.40	590	3.30	1,100		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the 1905 curve, and is not well defined.

Rating tables for Little Truckee River at Pine station, Cal.—Continued.

JUNE 20 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	78	1.50	247	2.40	635	3.30	1,195
.70	90	1.60	276	2.50	695	3.40	1,260
.80	103	1.70	306	2.60	755	3.50	1,325
.90	117	1.80	340	2.70	815	3.60	1,390
1.00	133	1.90	385	2.80	875	3.70	1,455
1.10	151	2.00	430	2.90	935	3.80	1,520
1.20	172	2.10	475	3.00	1,000	3.90	1,585
1.30	195	2.20	525	3.10	1,065	4.00	1,650
1.40	220	2.30	580	3.20	1,130		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1907 and the form of previous curves, and is well defined below gage height 2.0 feet.

Monthly discharge of Little Truckee River at Pine station, Cal., for 1907.

[Drainage area, 166 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	351	80	204	1.23	1.42	12,500	C.
February	330	165	229	1.38	1.44	12,700	C.
March	1,560	129	417	2.51	2.89	25,600	B.
April	1,360	418	974	5.87	6.55	58,000	B.
May	1,160	750	908	5.47	6.31	55,800	B.
June	1,130	440	761	4.58	5.11	45,300	B.
July	755	276	461	2.78	3.20	28,300	B.
August	247	103	149	.898	1.04	9,160	B.
September	117	84	95.4	.575	.64	5,680	B.
October	133	84	97.3	.586	.68	5,980	B.
November	125	90	96.9	.584	.65	5,770	C.
December	247	90	122	.735	.85	7,500	C.
The year	1,560	80	376	2.27	30.78	272.000	

NOTE.—Discharge estimated November 17 to 30. The open-channel rating has been applied throughout the year; discharges for January, February, and December are liable to be too large on account of ice.

Discharge measurements of Little Truckee River at Starr, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 18	E. A. Porter	85	92	1.80	292
July 9	M. B. Kennedy	53	55	1.20	126
October 17	E. A. Porter	45	41	.80	56

Daily gage height, in feet, of Little Truckee River at Starr, Cal., for 1908.

[S. Wallace, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	0.9	0.8	1.5	2.1	1.9	1.45	0.6	0.45	0.55	0.7	0.75
2	1.2	1.0	.9	1.6	2.4	1.9	1.35	.65	.45	.55	.7	.8
3	1.15	.9	.9	1.6	2.0	1.8	1.35	.65	.4	.55	.7	.75
4	1.05	1.0	1.0	1.85	1.85	1.7	1.3	.6	.4	.6	.7	.7
5	1.0	1.0	.95	1.95	1.8	1.75	1.3	.6	.4	.55	.7	.65
6	1.0	.95	1.0	1.8	1.95	1.85	1.25	.6	.45	.55	.7	.65
7	1.0	.9	1.0	1.7	2.1	1.95	1.2	.55	.45	.55	.7	.55
8	1.05	.95	.95	1.85	2.0	2.0	1.2	.55	.5	.55	.65	.7
9	1.0	.9	1.0	1.9	1.85	2.0	1.2	.6	.45	.55	.65	.7
10	1.15	.9	1.0	2.0	1.8	2.05	1.05	.55	.45	.55	.7	.55
11	1.3	.85	1.0	2.05	1.75	2.05	1.0	.55	.45	.55	.65	.75
12	1.3	.75	1.0	2.15	1.8	2.0	1.1	.6	.5	.55	.65	.8
13	1.3	.75	1.0	2.25	1.7	2.2	1.0	.7	.5	.55	.65	.75
14	1.3	.8	1.0	2.35	1.75	2.1	.95	.7	.5	.55	.65	.65
15	1.25	.8	1.2	2.35	1.7	2.0	.9	.7	.5	1.25	.6	.70
16	1.15	1.0	1.2	2.25	1.8	1.95	.9	.6	.5	1.0	.6	.85
17	1.15	.9	1.45	2.05	1.7	1.9	.85	.55	.55	.8	.55	.9
18	1.2	.8	1.55	2.1	1.6	1.75	.8	.5	.55	.7	.55	.9
19	1.1	.9	1.6	2.2	1.75	1.75	.8	.5	.55	.7	.55	.95
20	1.2	.9	1.6	2.4	1.6	1.75	.8	.5	.55	.7	.6	.95
21	.9	.9	1.65	2.4	1.65	1.7	.75	.45	.5	.75	.75	.95
22	.9	.8	1.65	2.3	1.7	1.6	.7	.45	.5	.7	.75	1.0
23	.9	.8	1.7	2.1	1.8	1.5	.7	.45	.5	.75	.75	1.05
24	.9	.85	1.8	2.0	1.95	1.5	.7	.45	.6	.75	.6	1.05
25	1.05	.85	1.85	1.9	2.1	1.65	.65	.45	.55	.75	.75	.9
26	1.05	.9	1.8	1.95	2.2	1.6	.65	.45	.55	.7	.7	.95
27	.9	.9	1.7	2.0	2.0	1.5	.65	.4	.55	.8	.85	.9
28	.85	.9	1.7	2.05	2.0	1.45	.65	.45	.55	.7	.85	.9
29	.8	.8	1.8	2.1	2.05	1.4	.6	.45	.55	.7	.85	.85
30	.9	.....	1.6	2.1	2.05	1.55	.6	.45	.55	.7	.8	1.05
31	.95	.....	1.6	.....	1.95	.....	.6	.45	.....	.7	.....	1.05

NOTE.—Ice conditions January 1 to 20, 25 to 23, and December 15 to 31.

Rating table for Little Truckee River at Starr, Cal., for January 1 to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	14	1.00	83	1.60	221	2.20	473
.50	22	1.10	100	1.70	255	2.30	523
.60	31	1.20	120	1.80	292	2.40	573
.70	42	1.30	141	1.90	331	2.50	625
.80	55	1.40	165	2.00	376		
.90	68	1.50	192	2.10	423		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908, and is well defined between gage heights 0.8 foot and 1.8 feet.

Monthly discharge of Little Truckee River at Starr, Cal., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	67.6	4,160	C.
February	83	48	65.9	3,790	C.
March	312	55	162	9,960	A.
April	573	192	316	23,600	A.
May	573	221	332	20,400	A.
June	473	165	297	17,700	A.
July	178	31	79.5	4,890	B.
August	42	14	26.0	1,600	B.
September	31	14	21.9	1,300	C.
October	130	26	40.7	2,500	B.
November	62	26	41.0	2,440	B.
December	.....	.....	38.7	2,380	C.
The year	573	14	131	94,700	

NOTE.—Discharge estimated January 1 to 20, 25, 26, and December 15 to 31, on account of ice conditions.

CARSON RIVER BASIN.

DESCRIPTION.

The Carson River basin includes that area which lies south of Lake Tahoe and between the Walker and Truckee river basins. Carson River is formed by its West and East forks, which rise in the extreme eastern part of California in a rugged and mountainous country heavily timbered with fir and pine, and flow northeastward to their union near the town of Gardnerville, Nev. From this point the river flows northward to Carson City, thence eastward through a rough and barren chain of hills and valleys, and finally discharges into the Carson Sink. The river is about 120 miles long, falling in this distance about 1,900 feet.

The water of the Carson is derived entirely from the snowfall and run-off from the high mountains. The basin contains no lakes, but many ideal reservoir sites are available near the headwaters and along the main river. These sites have been thoroughly investigated by the United States Reclamation Service and others interested.

Several fertile valleys lie along the course of this river and much land is unutilized for lack of water.

The minimum flow is all appropriated and the distribution of the water each year is the cause of much dissatisfaction. During the early spring and summer months the river is a raging torrent, but in the later summer the discharge is barely sufficient to supply the irrigation demand. By building reservoirs in the mountains this condition could be greatly improved and the waters of the two forks so controlled that the average daily flow would be greatly increased.

Good power sites are available along both forks of the river, but are at present wholly undeveloped.

Within the period for which records are available the wettest year was 1907 and the driest year 1905. The rate of run-off in these two years was three to one.

The following is a list of the stations maintained in the Carson River basin:

East Fork of Carson River at Rodenbah's ranch, near Gardnerville, Nev., 1900–1907.
East Fork of Carson River at Horseshoe Bend, near Gardnerville, Nev., 1908.
Carson River near Empire, Nev., 1900–1908.
Carson River near Hazen, Nev., 1908.
West Fork of Carson River at Woodfords, Cal., 1900–1908.

EAST FORK OF CARSON RIVER NEAR GARDNERVILLE, NEV.

This station, which was established October 17, 1900, at Rodenbah's ranch, about 5 miles southeast of Gardnerville, proved unsatisfactory, and on March 27, 1908, a new station was established at a place known as Horseshoe Bend, about 9 miles south of Gardnerville and 3 miles above the old station. This point is below all tributaries and

above all diversions. Measuring conditions are favorable, the section is permanent, and results are good.

Discharge measurements of East Fork of Carson River near Gardnerville, Nev., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	E. A. Porter	85	83.6	2.90	259
April 16	do	89	144	3.50	517
May 15	do	87	121	3.28	410
June 21	do	91	144	3.50	517
July 24	do	82	52	2.53	130
August 4	M. B. Kennedy	82	60	2.50	139

Daily gage height, in feet, of East Fork of Carson River near Gardnerville, Nev., for 1908.

[C. L. Berryhill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.9	2.6	2.5	2.9	3.9	3.5	3.2	2.5	2.5	2.5	2.4	2.4
2	3.9	2.5	2.4	2.8	3.7	3.4	3.1	2.6	2.5	2.5	2.4	2.4
3	3.9	2.6	2.4	2.8	3.6	3.4	3.1	2.7	2.5	2.5	2.4	2.4
4	3.9	2.5	2.5	2.9	3.5	3.4	3.1	2.6	2.5	2.5	2.4	2.4
5	4.1	2.6	2.6	3.0	3.7	3.5	3.1	2.5	2.5	2.5	2.4	2.4
6	3.7	2.6	2.5	3.0	3.8	3.6	3.1	2.5	2.5	2.5	2.4	2.4
7	3.6	2.7	2.4	3.0	3.9	3.7	3.1	2.5	2.5	2.5	2.4	2.4
8	3.6	2.6	2.5	2.9	3.5	3.7	3.0	2.5	2.5	2.5	2.4	2.4
9	3.7	2.7	2.6	2.9	3.4	3.8	3.0	2.5	2.5	2.5	2.4	2.4
10	3.7	2.6	2.6	3.0	3.3	4.1	2.9	2.5	2.5	2.5	2.4	2.4
11	3.5	2.6	2.6	3.3	3.5	4.0	2.9	2.5	2.5	2.4	2.4	2.4
12	3.1	2.7	2.7	3.4	3.5	3.8	3.0	2.5	2.5	2.4	2.4	2.4
13	3.0	2.6	2.7	3.6	3.5	4.2	2.9	2.5	2.5	2.4	2.4	2.4
14	2.8	2.6	2.7	3.8	3.4	3.7	2.9	2.5	2.5	2.4	2.4	2.5
15	2.8	2.7	2.7	3.5	3.3	3.6	2.8	2.5	2.5	2.7	2.4	2.5
16	2.7	2.7	2.7	3.5	3.2	3.6	2.8	2.5	2.5	2.5	2.4	2.4
17	2.7	2.6	2.8	3.4	3.2	3.6	2.7	2.5	2.5	2.5	2.4	2.4
18	2.7	2.5	2.7	3.6	3.3	3.5	2.7	2.5	2.5	2.4	2.4	2.4
19	2.8	2.6	2.7	3.8	3.3	3.5	2.7	2.5	2.5	2.4	2.4	2.3
20	2.8	2.6	2.8	3.9	3.4	3.5	2.6	2.5	2.5	2.4	2.4	2.4
21	2.7	2.5	2.8	3.9	3.4	3.4	2.6	2.5	2.5	2.4	2.4	2.5
22	2.7	2.5	2.8	3.7	3.5	3.4	2.6	2.5	2.5	2.4	2.4	2.5
23	2.7	2.5	2.7	3.5	3.5	3.4	2.6	2.5	2.5	2.4	2.4	2.4
24	2.8	2.6	2.8	3.3	3.6	3.2	2.5	2.5	2.5	2.4	2.4	2.5
25	2.9	2.5	2.7	3.2	3.7	3.2	2.5	2.5	2.5	2.4	2.4	2.5
26	2.8	2.6	3.0	3.5	3.8	3.2	2.5	2.5	2.5	2.4	2.5	2.5
27	2.8	2.4	2.9	3.6	3.7	3.3	2.5	2.5	2.5	2.4	2.5	2.5
28	2.9	2.5	2.9	3.8	3.8	3.2	2.5	2.5	2.5	2.4	2.4	2.5
29	2.7	2.4	2.9	3.9	3.9	3.2	2.5	2.5	2.5	2.4	2.4	2.5
30	2.7	.....	2.9	3.9	3.9	3.2	2.5	2.5	2.5	2.4	2.4	2.4
31	2.6	.....	2.9	.....	3.8	.....	2.5	2.5	.....	2.4	.....	2.4

NOTE.—Gage heights for January 1 to March 26 were observed at the old station at Rodenbah's ranch and have been reduced to readings at the new station by the approximate relation determined by simultaneous observations. Ice conditions December 18 to 31.

Rating table for East Fork of Carson River near Gardnerville, Nev., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	82	2.80	213	3.30	420	3.80	675
2.40	104	2.90	250	3.40	470	3.90	730
2.50	128	3.00	290	3.50	520	4.00	790
2.60	154	3.10	330	3.60	570	4.10	860
2.70	182	3.20	375	3.70	620	4.20	940

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1908, and is well defined between gage heights 2.5 feet and 3.5 feet.

Monthly discharge of East Fork of Carson River near Gardnerville, Nev., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	860	154	372	22,900	C.
February	182	104	148	8,510	C.
March	290	104	183	11,300	C.
April	730	213	470	28,000	A.
May	730	375	555	34,100	A.
June	860	375	539	32,100	A.
July	375	128	221	13,600	A.
August	182	128	131	8,060	A.
September	128	128	128	7,620	A.
October	182	104	116	7,130	A.
November	128	104	106	6,310	A.
December	128	82	111	6,820	C.
The year	860	82	257	186,000	

NOTE.—The open-channel rating has been applied throughout the year; discharges for the winter months are liable to be too large on account of ice conditions.

CARSON RIVER AND BRUNSWICK MILL POWER CANAL NEAR EMPIRE, NEV.

This station, which was established October 21, 1900, was originally located three-fourths mile east of Brunswick Mill and 2½ miles east of Empire, Nev. This gage was washed out by a flood March 19, 1907. On April 12, 1907, a new gage was installed on the crest of the diversion dam of the Brunswick Mill canal, 1½ miles below Empire and 6 miles east of Carson City, Nev. Only one measurement was referred to this gage, and elevation of the gage datum was not referred to the crest of the dam, therefore no discharges can be computed from this time until June 7, 1907, when a new gage was moved to the county bridge at Brunswick Mill, 500 feet below. All gage heights since that time refer to the same datum. The power canal of the mill has diverted water past the gage on the river since April 12, 1907, so its discharge must be added to give the total. As records have been kept on the canal only since April 13, 1908, the total flow of the river prior to that time can be estimated only approximately. The water is now used to pump water for irrigation, although formerly it was used to run a stamp mill.

The records at this point show the discharge of the river below the Gardnerville Valley and above the Dayton Valley, and are of value to the United States Reclamation Service in connection with the Truckee-Carson project and to the state engineer of Nevada in the adjustment of water rights.

Good results have been obtained on the river, but the gage in the canal is within the influence of backwater from the mill and is an index of the discharge for only a part of the time. Discharges for the canal are therefore only approximate. Ice interferes with records at times during the winter.

Discharge measurements of Carson River near Empire, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 7	E. A. Porter	96	739	[a] 8.50	3,300
July 14	do	93	616	7.30	1,880
August 1	do	106	595	6.45	1,000
August 9	do	100	473	5.30	604
August 23	do	82	319	4.30	262
1908.					
March 23	E. A. Porter	100	390	4.60	396
April 13	do	124	518	5.30	601
April 25	La Rue and Porter	119	445	4.82	412
May 5	E. A. Porter	122	484	5.15	557
May 16	do	118	454	4.90	430
June 29	do	113	376	4.25	245
October 13 [b]	do			2.50	32

[a] Gage height from gage on crest of dam 3.70 feet. [b] Measurement made by wading.

Daily gage height, in feet, of Carson River near Empire, Nev., for 1907 and 1908.

[David Lloyd, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.9	4.6	3.4	.....	2.4	3.3	8.0	6.4	4.3	3.7	4.1	4.0
2	3.3	4.7	3.4	.....	2.3	3.5	8.1	6.4	4.3	3.5	4.0	4.0
3	3.3	4.6	3.6	.....	2.3	3.6	7.9	6.3	4.3	3.5	4.0	4.1
4	3.4	4.4	3.7	.....	2.4	3.8	7.8	6.2	4.3	3.5	4.0	4.1
5	3.4	4.9	3.9	.....	2.5	3.9	8.1	6.1	4.3	3.5	4.1	4.1
6	3.3	4.7	4.2	.....	2.4	4.0	8.1	6.0	4.2	3.4	4.1	4.1
7	3.3	4.3	3.7	.....	2.3	8.6	8.1	5.9	4.2	3.6	4.1	4.5
8	3.3	4.1	3.5	.....	2.3	8.2	7.7	5.8	4.2	3.9	4.1	4.9
9	3.3	4.0	3.4	.....	2.4	8.0	7.7	5.5	4.2	3.9	4.1	4.6
10	3.2	4.0	3.6	.....	2.4	7.8	7.6	5.3	4.1	3.9	4.1	4.4
11	3.1	4.0	3.8	.....	2.6	7.8	7.5	5.1	4.1	3.9	4.1	4.6
12	3.0	3.9	3.7	2.2	2.8	8.1	7.5	5.0	4.1	3.9	4.2	4.7
13	2.8	3.8	3.6	2.4	2.8	8.4	7.4	4.9	4.0	3.9	4.2	4.9
14	2.8	3.9	3.7	2.6	2.5	7.9	7.4	4.9	4.0	3.9	4.2	4.7
15	2.7	3.8	3.7	2.8	2.3	7.6	7.3	4.8	4.0	3.9	4.2	4.4
16	2.8	3.8	3.8	2.6	2.4	7.3	7.2	4.7	3.9	3.9	4.1	4.3
17	2.7	3.8	5.2	2.3	2.6	7.0	7.1	4.7	3.9	3.9	4.1	4.3
18	2.6	3.7	7.3	2.3	2.8	7.0	6.9	4.6	3.9	3.9	4.1	4.3
19	2.6	3.7	.....	2.4	3.1	7.0	6.9	4.6	3.8	3.9	4.1	4.3
20	2.7	3.7	.....	2.5	3.3	7.2	6.9	4.5	3.8	3.9	4.1	4.3
21	2.8	3.7	.....	2.5	3.4	7.3	6.9	4.5	3.8	3.9	4.1	4.2
22	2.8	3.7	.....	2.5	3.1	7.4	6.7	4.4	3.8	3.9	4.1	4.2
23	2.8	3.7	.....	2.5	2.9	7.7	6.7	4.4	3.8	4.0	4.1	4.3
24	3.0	3.7	.....	2.5	2.6	7.7	6.6	4.3	3.7	4.0	4.1	4.3
25	3.1	3.6	.....	2.6	2.4	7.4	6.6	4.3	3.7	4.0	4.1	4.3
26	3.3	3.6	.....	2.6	2.5	7.4	6.7	4.2	3.7	4.1	4.1	4.3
27	3.3	3.5	.....	2.6	2.6	7.4	6.6	4.2	3.7	4.2	4.1	4.7
28	4.0	3.5	.....	2.6	2.7	7.6	6.5	4.2	3.7	4.3	4.0	4.8
29	5.5	.....	.....	2.6	2.8	7.7	6.5	4.2	3.7	4.2	4.0	4.6
30	5.2	.....	.....	2.6	2.9	8.0	6.6	4.2	3.7	4.1	4.0	4.3
31	4.5	.....	.....	.....	3.1	.....	6.5	4.3	.....	4.1	.....	4.3
1908.												
1	4.3	4.2	4.2	4.3	5.3	5.3	4.1	2.3	2.2	2.7	3.4	3.4
2	4.2	4.2	4.2	4.3	5.6	5.1	3.9	2.3	2.3	2.7	3.3	3.4
3	4.2	4.2	4.2	4.3	5.5	5.0	3.8	2.4	2.2	2.7	3.2	3.5
4	4.2	4.2	4.2	4.3	5.4	4.8	3.7	2.4	2.2	2.7	3.1	3.5
5	4.2	4.2	4.2	4.2	5.2	4.8	3.6	2.4	2.2	2.8	3.1	3.6
6	4.2	4.2	4.2	4.2	5.0	4.8	3.6	2.4	2.2	2.8	3.1	3.7
7	4.2	4.2	4.2	4.3	5.1	4.8	3.5	2.4	2.3	2.8	3.1	3.7
8	4.3	4.2	4.1	4.4	5.5	4.9	3.4	3.4	2.3	2.8	3.1	3.6
9	4.3	4.2	4.1	4.4	5.3	4.9	3.3	2.4	2.4	2.7	3.1	3.6
10	4.3	4.2	4.1	4.3	5.5	4.9	3.2	2.4	2.3	2.6	3.1	3.5

Daily gage height, in feet, of Carson River near Empire, Nev., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	4.3	4.3	4.2	4.2	5.3	5.0	3.1	2.3	2.3	2.6	3.2	3.4
12	4.3	4.3	4.2	4.2	5.1	5.0	3.0	2.4	2.3	2.6	3.2	3.4
13	4.3	4.3	4.2	5.0	4.9	5.1	3.5	2.3	2.3	2.5	3.2	3.4
14	4.3	4.1	4.3	5.3	4.9	5.1	4.0	2.4	2.3	2.7	3.2	3.4
15	4.3	4.1	4.3	5.5	5.0	5.1	3.6	2.3	2.3	2.8	3.2	3.4
16	4.3	4.1	4.5	5.4	4.9	5.1	3.3	2.3	2.4	3.0	3.2	3.7
17	4.3	4.1	4.6	5.2	4.9	5.0	3.1	2.2	2.4	3.3	3.3	3.7
18	4.3	4.1	4.7	5.0	4.9	5.0	3.0	2.2	2.5	3.1	3.3	3.5
19	4.3	4.1	4.8	5.2	4.7	4.8	.....	2.3	2.5	3.1	3.3	3.6
20	4.3	4.1	4.7	5.4	4.9	4.6	.....	2.3	2.5	3.0	3.3	3.5
21	4.3	4.1	4.7	5.6	4.9	4.4	.....	2.2	2.5	3.0	3.3	3.2
22	4.3	4.1	4.6	5.4	5.0	4.5	.....	2.2	2.5	2.9	3.3	3.1
23	4.3	4.1	4.6	5.4	5.2	4.4	.....	2.2	2.5	3.0	3.3	3.1
24	4.6	4.1	4.6	5.3	5.3	4.3	.....	2.2	2.5	3.0	3.4	3.1
25	4.5	4.2	4.6	5.2	5.5	4.2	.....	2.2	2.5	3.0	3.3	3.1
26	4.4	4.1	4.7	4.9	5.5	4.3	2.4	2.2	2.5	2.8	3.4	3.1
27	4.3	4.1	4.7	4.9	4.9	4.3	2.4	2.2	2.6	3.1	3.3	3.1
28	4.3	4.1	4.7	4.9	5.0	4.4	2.3	2.2	2.6	3.2	3.4	3.0
29	4.3	4.1	4.5	5.2	5.0	4.3	2.3	2.2	2.6	3.3	3.3	2.9
30	4.3	.....	4.4	5.0	5.1	4.1	2.3	2.2	2.7	3.3	3.3	2.8
31	4.3	.....	4.3	.....	5.3	.....	2.3	2.2	.....	3.2	.....	2.7

NOTE.—Gage heights January 1 to March 18, 1907, are from the old gage; April 12 to June 6 they are from gage on crest of dam; after June 7, 1907, they are from gage at bridge. Ice conditions December 16 to 21, 1908, and probably at other times.

Rating tables for Carson River near Empire, Nev.

JANUARY 1, 1906, TO MARCH 18, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	173	3.70	554	4.80	1,230	5.90	2,045
2.70	197	3.80	603	4.90	1,300	6.00	2,120
2.80	223	3.90	654	5.00	1,370	6.20	2,270
2.90	251	4.00	708	5.10	1,445	6.40	2,420
3.00	281	4.10	765	5.20	1,520	6.60	2,570
3.10	313	4.20	825	5.30	1,595	6.80	2,720
3.20	347	4.30	890	5.40	1,670	7.00	2,870
3.30	384	4.40	955	5.50	1,745	7.20	3,020
3.40	423	4.50	1,020	5.60	1,820	7.40	3,170
3.50	464	4.60	1,090	5.70	1,895		
3.60	508	4.70	1,160	5.80	1,970		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1902 to 1906, and is well defined.

JUNE 7, 1907, TO DECEMBER 31, 1908.

2.20	17	3.50	118	4.80	410	6.20	1,100
2.30	22	3.60	130	4.90	445	6.40	1,220
2.40	27	3.70	143	5.00	480	6.60	1,360
2.50	32	3.80	158	5.10	520	6.80	1,500
2.60	38	3.90	175	5.20	560	7.00	1,660
2.70	44	4.00	195	5.30	600	7.20	1,820
2.80	51	4.10	215	5.40	650	7.40	2,000
2.90	58	4.20	235	5.50	700	7.60	2,180
3.00	65	4.30	260	5.60	750	7.80	2,370
3.10	73	4.40	285	5.70	800	8.00	2,570
3.20	82	4.50	315	5.80	860	8.20	2,770
3.30	94	4.60	345	5.90	920	8.40	2,970
3.40	106	4.70	375	6.00	980	8.60	3,170

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1907–8, and is fairly well defined.

Monthly discharge of Carson River near Empire, Nev., for 1907 and 1908.

[Drainage area 988 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,740	173	444	0.449	0.52	27,300	C.
February	1,300	464	717	.726	.76	39,800	B.
March 1–18	4,000	423	791	.801	.54	28,200	B.
June 7–30	3,170	1,660	2,240	.....	.....	107,000	B.
July	2,670	1,290	1,880	.....	.....	116,000	B.
August	1,220	235	539	.....	.....	33,100	A.
September	260	143	193	.....	.....	11,500	A.
October	260	106	175	.....	.....	10,800	A.
November	235	195	214	.....	.....	12,700	A.
December	445	195	288	.....	.....	17,700	A.
The period	.....	.....	.....	.....	.....	404,000	C.
1908.							
January	345	235	260	.....	.....	16,000	C.
February	260	215	227	.....	.....	13,100	C.
March	410	215	293	.....	.....	18,000	B.
April	750	235	444	.....	.....	26,400	A.
May	750	375	546	.....	.....	33,600	A.
June	600	215	400	.....	.....	23,800	A.
July	215	22	84.5	.....	.....	5,200	B.
August	27	17	21.5	.....	.....	1,320	B.
September	44	17	27.0	.....	.....	1,610	B.
October	94	32	59.0	.....	.....	3,630	B.
November	106	73	87.9	.....	.....	5,230	B.
December	143	44	95.3	.....	.....	5,800	C.
The year	750	17	212	.....	.....	154,000	

NOTE.—These estimates do not include the flow of the power canal which has diverted water past the station since April 12, 1907. See below for records on the canal.

Discharge measurements of Brunswick Mill power canal near Empire, Nev., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	E. A. Porter	16	45.7	3.60	28.5
April 25	La Rue and Porter	13	21.4	1.60	33.1
May 5	E. A. Porter	13	21.4	1.60	33.1
July 26	do	.....	27.2	2.00	28.3
October 13	do	.....	.....	3.20	47.4

NOTE.—Gage heights of most of these measurements were affected by backwater from the mill.

Daily gage height, in feet, of Brunswick Mill power canal near Empire, Nev., for 1908.

[David Lloyd, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.6	3.0	2.0	2.0	1.9	3.7	3.8	1.6
2	.....	1.7	2.9	2.1	2.0	1.8	3.9	3.7	1.6
3	.....	1.7	2.6	2.1	3.8	1.7	4.0	3.8	1.7
4	.....	1.7	2.6	2.0	3.8	1.9	4.0	1.9	1.7
5	.....	1.7	2.8	2.0	2.6	1.8	4.2	1.9	1.6
6	.....	1.7	2.6	2.0	3.2	1.6	4.2	1.9	1.8
7	.....	1.7	2.6	1.9	3.5	1.9	4.1	1.8	1.7
8	.....	1.7	2.7	1.9	3.2	2.6	4.0	3.1	1.6
9	.....	1.7	2.5	1.9	3.2	3.0	3.9	3.2	1.8
10	.....	1.7	2.6	2.0	3.6	1.6	3.8	3.4	1.8
11	.....	1.7	2.8	2.0	3.0	1.6	3.8	3.1	1.7
12	.....	1.7	2.9	1.9	3.7	1.6	3.9	3.0	1.8
13	.....	1.7	3.0	1.8	3.2	2.0	3.9	3.2	1.8
14	1.8	1.7	3.0	1.8	3.6	1.8	3.9	3.4	1.8
15	1.8	2.0	3.0	1.9	2.7	2.1	4.0	3.3	1.8
16	1.8	2.0	2.9	1.8	2.8	1.9	4.1	3.4	1.7
17	1.8	1.7	2.9	1.9	2.0	2.7	4.4	3.3	1.8
18	1.8	1.8	2.8	1.9	1.8	2.6	4.1	3.4	1.7
19	1.8	1.8	2.9	2.0	1.8	2.7	4.2	3.4	1.8
20	1.8	1.8	2.6	1.9	1.8	3.6	4.3	3.3	1.8
21	1.8	1.9	2.6	1.9	1.1	3.5	4.3	3.4	1.7
22	1.8	1.9	2.0	1.9	.7	3.5	4.2	2.1	1.8
23	1.7	1.6	2.0	2.4	.8	3.5	4.3	2.2	1.6
24	1.7	2.9	3.0	2.4	1.0	3.6	4.2	1.7	1.7
25	1.7	3.0	3.0	2.4	.8	3.5	4.1	1.8	1.8
26	1.7	3.0	2.5	2.0	1.1	3.5	2.7	1.6	1.7
27	1.7	3.0	2.5	2.0	.8	3.6	3.8	1.8	1.6
28	1.7	3.0	2.9	2.1	.9	3.8	3.7	1.7	1.6
29	1.6	3.0	1.9	2.1	2.0	3.7	3.7	1.6	1.4
30	1.6	3.0	2.0	1.6	1.0	3.8	3.8	1.6	1.5
31	.....	3.1	.....	1.6	2.1	.....	3.8	.....	1.4

NOTE.—Many of these gage heights were affected by backwater.

Monthly discharge of Brunswick power canal near Empire, Nev., for 1908.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
April 13–30	31	1,110
May	33	2,030
June	33	1,960
July	28	1,720
August	25	1,540
September	35	2,080
October	45	2,770
November	45	2,680
December	37	2,280
The period	.....	18,200

NOTE.—These discharges have been estimated partly from such gage heights as seem to be unaffected by backwater, and partly by interpolation between measurements, and are approximate. The discharge of the canal seems to remain fairly constant, and was probably about the same for 1907.

CARSON RIVER NEAR HAZEN, NEV.

This station, which is located about 16 miles south of Hazen and above Truckee canal chute, was established January 12, 1908, to determine the amount of water from Carson River available for storage in connection with the Truckee-Carson project of the United States Reclamation Service. A reservoir of about 100,000 acre-feet

capacity will be erected at this point to conserve the flood waters of the Carson and also the water delivered by the Truckee canal.

To avoid the effect of backwater from the canal chute the gage was moved upstream on April 28, 1908. Gage heights prior to that time are of no value. Sufficient measurements have not yet been made to define a rating curve for this station.

Discharge measurements of Carson River near Hazen, Nev., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 17	M. B. Kennedy	.....	100	2.60	134
October 21	E. A. Porter	96	91	2.40	73

Daily gage height, in feet, of Carson River near Hazen, Nev., for 1908.

[Fred Foster, observer.]

Day.	May.	June.	July.	Oct.	Nov.	Dec.	Day.	May.	June.	July.	Oct.	Nov.	Dec.
1	3.5	3.6	2.9	.....	2.5	2.6	16	3.5	3.5	2.6	2.2	2.45	2.65
2	3.5	3.55	2.9	.....	2.5	2.6	17	3.5	3.5	2.6	2.2	2.45	2.65
3	3.6	3.5	2.8	.....	2.5	2.6	18	3.4	3.5	2.6	2.3	2.5	2.75
4	3.65	3.45	2.7	.....	2.5	2.6	19	3.35	3.45	2.5	2.3	2.5	2.65
5	3.7	3.35	2.7	2.0	2.5	2.6	20	3.3	3.45	2.5	2.3	2.5	2.5
6	3.6	3.3	2.7	2.0	2.5	2.6	21	3.3	3.35	2.5	2.4	2.5	2.5
7	3.5	3.35	2.7	2.0	2.5	2.6	22	3.4	3.25	2.4	2.4	2.5	2.5
8	3.55	3.3	2.7	2.0	2.5	2.6	23	3.4	3.1	2.4	2.3	2.5	2.5
9	3.6	3.3	2.7	2.1	2.5	2.6	24	3.5	3.5	2.3	2.3	2.5	2.5
10	3.7	3.3	2.7	2.1	2.5	2.6	25	3.5	3.0	2.3	2.3	2.55	2.6
11	3.55	3.3	2.7	2.1	2.5	2.6	26	3.6	3.0	2.25	2.3	2.55	2.65
12	3.5	3.35	2.6	2.2	2.45	2.6	27	3.7	3.0	2.2	2.4	2.6	2.8
13	3.4	3.4	2.6	2.2	2.45	2.6	28	3.6	3.0	2.1	2.4	2.6	2.75
14	3.4	3.5	2.7	2.2	2.45	2.6	29	3.55	3.0	2.0	2.4	2.6	2.75
15	3.5	3.5	2.6	2.2	2.45	2.65	30	3.45	3.0	.....	2.5	2.6	2.6
							31	3.5	.....	.....	2.5	.....	2.65

NOTE.—The river was dry or standing in pools July 30 to October 4; gage heights estimated October 5 to 24. River frozen or slush ice running, November 25 to December 31. Gage was probably affected only part of the time.

WEST FORK OF CARSON RIVER NEAR WOODFORDS, CAL.

West Fork of Carson River rises in Alpine County, Cal., flows in a general northerly direction, and unites with East Fork in Douglas County, Nev.

The gaging station, which is located about three-fourths mile above the post-office at Woodfords, Cal., and 200 feet from the main road between Woodfords and Blue Lake, was established October 18, 1900, to determine the flow of the stream available for storage. On May 18, 1907, the gage and bench mark were washed out, and on June 8 the gage was reestablished at the same location.

The stream bed is permanent but is very uneven, and the current is very rough. The measurements prior to 1907, though scattering, give a fairly well-defined curve. Sufficient measurements have not yet been referred to the new gage to define a rating curve. The extent of ice conditions during the winter is not definitely known.

Discharge measurements of West Fork of Carson River near Woodfords, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	E. A. Porter	40	137	4.30	684
July 9	do	38	131	4.00	578
August 3	do	29	80	2.90	229
1908.					
June 26	E. A. Porter	29	68	2.07	137
July 25	do	27	44	1.00	55
August 31	M. B. Kennedy	26	45	[a] 1.40	46
October 12	E. A. Porter	25	31	.90	31

[a] Gage height uncertain; may have been 1.04.

NOTE.—Gage heights of all measurements refer to the datum of gage used after June 8, 1907.

Daily gage height, in feet, of West Fork of Carson River near Woodfords, Cal., for 1907 and 1908.

[Miss Bernice Merrill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	2.85	3.2	3.45	4.9	.....	.....	3.1	2.2	.....	1.55	1.25
2	.....	3.3	3.15	3.5	4.8	.....	.....	3.2	2.2	.....	1.5	1.2
3	.....	3.3	3.1	3.55	4.8	.....	.....	3.2	2.1	.....	1.5	1.2
4	.....	3.35	3.2	3.55	4.9	.....	.....	3.2	2.1	.....	1.5	1.3
5	.....	3.4	3.2	3.6	4.9	.....	.....	3.0	2.1	1.5	1.5	1.35
6	.....	3.5	3.2	3.7	5.0	.....	.....	3.0	2.0	1.5	1.5	1.5
7	.....	3.45	3.2	3.75	5.0	.....	.....	3.0	2.0	1.5	1.5	1.65
8	.....	3.3	3.2	3.75	4.9	4.1	.....	3.0	2.0	1.5	1.6	1.6
9	2.9	3.2	3.2	3.85	4.95	4.2	3.9	2.9	2.0	1.5	1.55	1.7
10	2.8	3.2	.....	3.95	5.0	4.4	3.7	2.9	2.0	1.5	1.55	1.8
11	2.8	3.3	.....	4.3	5.0	4.0	3.9	2.8	2.0	1.45	1.5	1.75
12	2.85	3.35	3.15	4.6	5.0	3.9	3.8	2.8	.....	1.5	1.55	1.7
13	2.8	3.35	3.1	4.8	5.0	4.1	3.6	2.8	.....	1.5	1.55	1.6
14	2.8	3.3	3.1	5.0	5.2	4.0	3.5	2.8	.....	1.5	1.55	1.5
15	2.8	3.3	3.0	4.85	5.6	3.9	3.4	2.7	.....	1.5	1.5	1.5
16	2.75	3.3	3.05	5.0	5.8	3.8	3.4	2.75	.....	1.55	1.5	1.55
17	2.7	3.3	4.0	4.9	6.6	3.9	3.4	2.6	.....	1.55	1.45	1.5
18	2.7	3.2	4.75	4.8	.....	4.0	3.5	2.6	.....	1.5	1.4	1.5
19	2.7	3.15	4.7	5.2	.....	4.2	3.6	2.5	.....	1.35	1.4	.....
20	2.75	3.1	4.4	5.1	.....	4.1	3.6	2.4	.....	1.6	1.3	.....
21	2.75	3.2	4.2	4.9	.....	4.0	3.8	2.4	.....	1.6	1.25	.....
22	2.75	3.25	4.1	5.0	.....	3.9	3.9	2.4	.....	1.55	1.3	1.55
23	2.7	3.2	.....	5.1	.....	4.0	3.7	2.3	.....	1.5	1.4	1.5
24	2.7	3.2	.....	5.35	.....	4.2	3.6	2.3	.....	1.7	1.4	1.55
25	2.7	3.25	3.8	5.6	.....	4.3	3.6	2.2	.....	1.75	1.5	1.6
26	2.75	3.2	3.8	5.2	.....	4.4	3.4	2.1	.....	1.8	1.5	1.6
27	2.85	3.2	3.7	5.0	.....	4.5	3.3	2.1	.....	1.75	1.4	1.9
28	2.85	3.2	3.65	4.9	.....	5.0	3.5	2.1	.....	1.6	1.3	1.85
29	2.8	.....	3.5	5.0	.....	5.2	3.4	2.1	.....	1.6	1.2	1.85
30	2.75	.....	3.5	4.9	.....	5.1	3.2	2.0	.....	1.55	1.2	1.8
31	2.75	.....	3.45	.....	.....	.....	3.0	2.0	.....	1.55	.....	1.8
1908.												
1	1.8	1.5	1.5	2.1	3.0	2.5	.....	4.2	1.0	1.0	1.15	1.0
2	1.7	1.5	1.45	2.1	3.0	2.5	1.9	3.5	1.0	1.0	1.2	1.0
3	1.75	1.45	1.4	2.2	3.05	2.55	1.9	1.5	1.0	.95	1.1	1.0
4	1.45	1.45	1.4	2.2	3.0	2.6	1.8	1.3	.95	1.0	1.1	1.1
5	1.5	1.45	1.4	2.2	2.9	2.5	1.8	1.3	.95	1.0	1.1	1.0
6	1.5	1.5	1.45	2.25	2.9	2.5	1.8	1.2	1.0	1.1	1.0	1.1
7	1.45	1.45	1.45	2.2	2.8	2.5	1.7	1.2	.9	1.0	1.0	1.1
8	1.45	1.4	1.5	2.25	2.9	2.5	1.65	1.2	.9	1.05	1.0	1.05
9	1.5	1.4	1.55	2.3	2.8	2.45	1.5	1.25	.95	1.05	1.1	1.0
10	1.45	1.4	1.55	2.35	2.8	2.5	1.5	1.2	1.0	1.1	1.0	1.0

Daily gage height, in feet, of West Fork of Carson River near Woodfords, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	1.45	1.4	1.5	2.35	2.7	2.5	1.4	1.15	1.1	.....	0.95	1.0
12	1.5	1.4	1.55	2.4	2.75	2.5	1.35	1.1	1.1	1.15	.9	1.1
13	1.4	1.4	1.55	2.45	2.65	2.5	1.4	1.1	1.1	1.2	.9	1.1
14	1.4	1.4	1.6	2.4	2.65	2.45	1.35	1.1	.95	1.2	1.0	1.05
15	1.4	1.45	1.7	2.45	2.65	2.4	1.3	1.0	1.0	1.3	1.0	1.0
16	1.4	1.4	1.8	2.5	2.6	2.35	1.2	1.0	1.0	1.9	.95	.95
17	1.4	1.4	1.8	2.5	2.6	2.3	1.0	1.15	1.0	1.5	.9	.95
18	1.4	1.35	1.8	2.5	2.55	2.3	1.0	1.1	1.0	1.25	.9	1.0
19	1.4	1.35	1.8	2.55	2.5	2.35	.9	1.1	1.05	1.25	.9	.95
20	1.45	1.4	1.9	2.6	2.5	2.35	(a)	1.1	1.05	1.2	.95	1.8
21	1.4	1.45	1.9	2.6	2.55	2.3	(a)	1.0	1.0	1.25	1.0	1.7
22	1.45	1.45	1.95	2.6	2.5	2.3	(a)	1.1	.95	1.25	1.0	1.0
23	1.45	1.5	1.9	2.7	2.6	2.2	(a)	1.1	.95	1.25	1.1	1.0
24	1.4	1.5	1.95	2.8	2.55	2.1	.95	1.15	.9	1.2	1.0	1.1
25	1.4	1.5	1.95	2.7	2.5	2.0	1.0	1.15	.9	1.2	.95	1.15
26	1.4	1.5	1.95	2.65	2.5	1.95	1.0	1.1	.9	1.2	.8	1.15
27	1.45	1.6	2.0	2.7	2.5	1.9	1.1	1.1	.95	1.1	.8	1.1
28	1.5	1.65	2.0	2.8	2.5	1.9	1.2	1.1	.9	1.1	.9	1.0
29	1.5	1.6	2.0	2.9	2.55	1.85	1.2	1.1	.95	1.15	.9	1.0
30	1.5	.....	2.0	3.0	2.6	1.9	1.1	1.05	.95	1.2	.95	1.0
31	1.5	.....	2.0	.....	2.5	.....	1.1	1.0	.....	1.15	.....	1.1

[a] Gage out of water.

NOTE.—The gage was washed out May 18, 1907, and replaced at a different datum June 8.

Rating table for West Fork of Carson River near Woodfords, Cal., from January 1, 1906, to May 17, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	69	3.70	226	4.70	535	5.70	960
2.80	79	3.80	251	4.80	570	5.80	1,010
2.90	90	3.90	277	4.90	610	5.90	1,060
3.00	102	4.00	305	5.00	650	6.00	1,110
3.10	115	4.10	335	5.10	690	6.10	1,165
3.20	129	4.20	365	5.20	730	6.20	1,220
3.30	145	4.30	395	5.30	775	6.30	1,275
3.40	163	4.40	430	5.40	820	6.40	1,330
3.50	182	4.50	465	5.50	865	6.50	1,390
3.60	203	4.60	500	5.60	910	6.60	1,450

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1902 to 1906, and is well defined.

Monthly discharge of West Fork of Carson River near Woodfords, Cal., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet.)	Accuracy.
	Maximum.	Minimum.	Mean.		
January 9–31	90	69	76	3,460	C.
February	182	84	139	7,720	B.
March	552	102	211	13,000	B.
April	910	172	502	29,900	B.
May 1–17	1,450	570	718	24,200	B.

WALKER RIVER BASIN.

DESCRIPTION.

Walker River rises on the eastern slope of the Sierra Nevada in two main branches whose basins are separated by a group of mountains known as the Sweetwater Range. The East Fork of Walker River receives the drainage from the eastern slope of the Sweetwater Range and from the western slope of the Walker River Range; the West Fork flows at the base of the main range of the Sierra Nevada. From the union of the forks, near Yerington, the river flows sluggishly northward, passing through the fertile Yerington Valley (Mason Valley) to a point east of Wabuska, where it turns to the east and southeast, and 60 miles beyond enters Walker Lake. The length of the river is about 120 miles, in which distance its fall is about 1,600 feet.

The basin contains but three important valleys—Antelope Valley on the West Fork, Smith Valley, a fertile tableland presenting ample opportunity for reclamation, also under the West Fork, and Yerington Valley, which takes its water from the two forks. Only recently have the water rights in this last-named valley been adjusted. The minimum flow is not sufficient to supply the demand during the summer months, although excellent reservoir sites near the headwaters of the forks are available for storing the flood waters for use during the dry season. The snowfall in the winter months is very heavy, giving assurance of an ample supply for reservoirs.

No irrigation projects are at present being constructed, but surveys have been made by the Reclamation Service to show the feasibility of such projects. A line of levels run by the Reclamation Service from a point above Yerington to Carson River near Towle's ranch shows that water can be easily diverted by gravitation from Walker River to the Carson. The opportunities for power development afforded by both forks are as yet undeveloped by private companies because of the small demand for power near the rivers. Power development from the main stream is not feasible.

Only three gaging stations have been maintained for any great length of time in the Walker River drainage basin, and these were discontinued July 31, 1908, owing to lack of funds.

The stations are as follows:

East Fork of Walker River near Yerington, Nev., 1902–1908.
Walker River near Nordyke, Nev., 1895.
Walker River near Wabuska, Nev., 1902–1908.
West Fork of Walker River near Coleville, Cal., 1902–1908.

Very reliable estimates of flow of the river can be obtained by adding the run-off of the two forks.

EAST FORK OF WALKER RIVER NEAR YERINGTON, NEV.

This station, which was established October 6, 1902, to determine the quantity of flow available for storage and irrigation, was located at Ross ranch, about 10 miles southeast of Yerington, Nev., near the junction with West Fork. The station was discontinued July 31, 1908.

The stream bed is of shifting sand and clay, and satisfactory results could not be obtained with the small number of measurements that could be made. Information as to ice conditions is meager. The datum of the gage remained unchanged.

Discharge measurements of East Fork of Walker River near Yerington, Nev., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 13	E. A. Porter	93	285	4.70	1,030
July 12	do	84	301	4.82	1,110
August 6	do	82	203	4.10	685
August 27	do	77	139	3.30	408
1908.					
April 18	E. A. Porter	67	69	2.50	137

Daily gage height, in feet, of East Fork of Walker River near Yerington, Nev., for 1907 and 1908.

[I. A. Strosnider, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.9	2.9	2.6	3.0	3.6	3.9	4.8	4.3	3.3	2.5	2.9	2.3
2	2.9	2.9	2.6	3.0	3.6	4.05	4.8	4.3	3.2	2.5	2.9	2.4
3	3.0	3.0	2.6	3.0	3.6	4.1	4.9	4.3	3.2	2.4	2.9	2.4
4	3.0	3.05	2.6	2.9	3.6	4.2	5.0	4.2	3.2	2.4	2.8	2.4
5	3.0	3.15	2.7	2.9	3.7	4.2	[a] 5.1	4.2	3.1	2.4	2.8	2.4
6	3.0	3.35	2.7	2.8	3.7	4.3	5.0	4.1	3.1	2.4	2.8	2.4
7	3.0	3.65	2.7	2.8	3.7	4.3	5.0	4.05	3.1	2.4	2.8	2.3
8	2.9	3.8	2.7	2.8	3.7	4.4	4.95	4.0	3.0	2.5	2.7	2.3
9	2.9	3.6	2.7	2.8	3.8	4.4	4.9	4.0	3.0	2.5	2.7	2.3
10	2.8	3.4	2.7	2.9	3.8	4.5	4.9	3.9	3.0	2.5	2.7	2.3
11	2.7	3.2	2.8	2.9	3.9	4.4	4.8	3.9	3.0	2.5	2.7	2.3
12	2.7	3.0	2.8	2.9	3.9	4.35	4.8	3.8	3.0	2.5	2.6	2.2
13	2.6	3.0	2.8	2.9	3.8	4.3	4.7	3.8	2.9	2.6	2.6	2.2
14	2.6	2.9	2.8	3.0	3.75	4.2	4.7	3.7	2.9	2.6	2.6	2.2
15	2.5	2.9	2.8	3.0	3.65	4.1	4.6	3.7	2.9	2.6	2.6	2.2
16	2.5	2.8	2.8	3.0	3.6	4.0	4.6	3.6	2.9	2.6	2.5	2.2
17	2.4	2.8	2.8	3.0	3.6	3.95	4.5	3.6	2.9	2.6	2.5	2.2
18	2.4	2.8	3.8	3.1	3.7	3.85	4.5	3.6	2.9	2.6	2.5	2.2
19	2.4	2.5	[a] 6.0	3.1	3.75	3.8	4.4	3.6	2.9	2.7	2.5	2.3
20	2.4	2.7	[a] 5.4	3.2	3.95	3.8	4.5	3.6	2.8	2.7	2.5	2.3
21	2.4	2.7	4.9	3.2	4.0	3.9	4.5	3.5	2.8	2.7	2.4	2.3
22	2.4	2.7	3.7	3.3	4.0	4.0	4.5	3.5	2.7	2.7	2.4	2.3
23	2.45	2.7	3.45	3.4	3.9	4.1	4.6	3.5	2.7	2.7	2.4	2.3
24	2.5	2.6	3.4	3.4	3.9	4.1	4.6	3.5	2.7	2.7	2.4	2.4
25	2.5	2.6	3.3	3.4	3.9	4.2	4.6	3.5	2.6	2.7	2.4	2.4
26	2.6	2.6	3.2	3.5	3.8	4.3	4.5	3.4	2.6	2.8	2.3	2.4
27	2.6	2.6	3.2	3.5	3.8	4.4	4.5	3.4	2.6	2.8	2.3	2.4
28	2.7	2.6	3.1	3.5	3.8	4.5	4.4	3.4	2.5	2.8	2.3	2.4
29	2.7	.....	3.1	3.5	3.7	4.6	4.4	3.4	2.5	2.8	2.3	2.5
30	2.8	.....	3.0	3.6	3.7	4.7	4.4	3.3	2.5	2.8	2.3	2.5
31	2.8	.....	3.0	.....	3.8	.....	4.4	3.3	.....	2.8	.....	2.5

[a] Water over top of gage; gage height estimated.

Daily gage height, in feet, of East Fork of Walker River near Yerington, Nev., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1908.								1908.							
1....	2.5	2.5	2.5	2.9	2.3	2.1	2.0	16....	2.6	2.4	3.2	2.6	2.0	2.1	2.3
2....	2.5	2.5	2.5	2.9	2.2	2.0	2.0	17....	2.6	2.4	3.3	2.6	2.0	2.1	2.2
3....	2.5	2.5	2.5	2.9	2.2	2.0	2.0	18....	2.6	2.4	3.3	2.6	2.0	2.1	2.2
4....	2.5	2.5	2.5	2.9	2.1	2.0	2.0	19....	2.6	2.4	3.3	2.6	2.0	2.1	2.3
5....	2.5	2.5	2.5	2.8	2.1	2.0	2.1	20....	2.6	2.4	3.3	2.6	2.0	2.0	2.3
6....	2.6	2.5	2.6	2.8	2.0	2.0	2.1	21....	2.6	2.4	3.2	2.5	2.0	2.0	2.4
7....	2.6	2.5	2.6	2.8	2.0	2.0	2.1	22....	2.6	2.4	3.2	2.5	2.0	2.0	2.4
8....	2.6	2.5	2.6	2.8	2.0	2.0	2.2	23....	2.6	2.5	3.2	2.5	2.0	2.0	2.4
9....	2.6	2.5	2.6	2.8	2.0	2.1	2.3	24....	2.6	2.6	3.2	2.5	2.0	2.0	2.4
10....	2.6	2.5	2.7	2.7	2.0	2.1	2.45	25....	2.6	2.7	3.2	2.4	2.0	2.0	2.5
11....	2.6	2.5	2.7	2.7	2.0	2.1	2.5	26....	2.5	2.7	3.2	2.4	2.0	2.0	2.5
12....	2.6	2.4	2.8	2.7	2.0	2.2	2.5	27....	2.5	2.6	3.1	2.4	2.1	2.0	2.6
13....	2.6	2.4	2.8	2.7	2.0	2.2	2.5	28....	2.5	2.6	3.1	2.4	2.1	2.1	2.6
14....	2.6	2.4	2.9	2.7	2.0	2.1	2.4	29....	2.5	2.5	3.1	2.3	2.1	2.0	2.7
15....	2.6	2.4	3.1	2.7	2.0	2.1	2.4	30....	2.5	.....	3.0	2.3	2.1	2.0	2.7
								31....	2.5	.....	3.0	.....	.....	.....	2.7

Rating tables for East Fork of Walker River near Yerington, Nev.

JANUARY 1 TO MARCH 18, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	108	2.80	192	3.20	308	3.60	460
2.50	126	2.90	218	3.30	344	3.70	500
2.60	146	3.00	246	3.40	381	3.80	540
2.70	168	3.10	276	3.50	420		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1906 and the form of the subsequent curve, and is fairly well defined.

MARCH 19, 1907, TO JULY 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	55	2.90	240	3.80	585	4.70	1,030
2.10	69	3.00	270	3.90	630	4.80	1,080
2.20	83	3.10	305	4.00	680	4.90	1,130
2.30	99	3.20	340	4.10	730	5.00	1,180
2.40	117	3.30	375	4.20	780	5.20	1,280
2.50	137	3.40	410	4.30	830	5.40	1,380
2.60	160	3.50	450	4.40	880	5.60	1,480
2.70	185	3.60	495	4.50	930	5.80	1,580
2.80	212	3.70	540	4.60	980	6.00	1,700

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1907–8, and is fairly well defined above gage height 2.5 feet.

Monthly discharge of East Fork of Walker River near Yerington, Nev., for 1907 and 1908.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	246	108	168	0.153	0.18	10,300	C.
February	540	126	243	.221	.23	13,500	B.
March	1,700	146	364	.331	.38	22,400	C.
April	495	212	312	.284	.32	18,600	B.
May	680	495	569	.517	.60	35,000	B.
June	1,030	585	779	.708	.79	46,400	B.
July	1,230	880	1,020	.927	1.07	62,700	B.
August	830	375	564	.513	.59	34,700	B.
September	375	137	240	.218	.24	14,300	B.
October	212	117	164	.149	.17	10,100	B.
November	240	99	157	.143	.16	9,340	B.
December	137	83	105	.095	.11	6,460	C.
The year	1,700	83	390	.355	4.84	284,000	
1908.							
January	160	137	152	.138	.16	9,350	C.
February	185	117	135	.123	.13	7,760	B.
March	375	137	258	.235	.27	15,900	B.
April	240	99	171	.155	.17	10,200	B.
May	99	55	61.4	.056	.06	3,780	C.
June	83	55	62.0	.056	.06	3,690	C.
July	185	55	112	.102	.12	6,890	B.
The period						57,600	

NOTE.—The open-channel rating has been applied throughout. Discharges for the winter months may be too large, on account of ice.

WALKER RIVER NEAR WABUSKA, NEV.

This station, which was located about 300 feet above the Carson and Colorado Railroad bridge, near the section house at Clever station and about 2½ miles east of Wabuska, was established July 22, 1902, to determine the amount of water flowing into Walker Lake and also the amount of water returned by seepage, as the locality is below all diversions for irrigation. The station was discontinued July 31, 1908. The gage datum has remained unchanged.

The records are unreliable because of the shifting river bed. For 1908, gage heights only are available.

Discharge measurements of Walker River near Wabuska, Nev., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 14	E. A. Porter	148	536	5.50	1,550
July 13	do	152	673	5.80	2,410
August 7	do	141	389	4.40	1,180

Daily gage height, in feet, of Walker River near Wabuska, Nev., for 1907 and 1908.

[A. Gelmstedt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.3	2.45	.....	3.1	3.75	4.65	5.65	4.4	2.4	2.0	2.6	2.2
2	2.2	2.4	.....	3.4	3.65	4.9	6.2	4.3	2.35	1.9	2.6	2.25
3	2.1	2.4	.....	3.35	3.55	5.2	6.3	4.3	2.35	2.0	2.5	2.3
4	2.0	2.4	2.4	3.3	3.85	5.45	6.15	4.2	2.3	2.0	2.35	2.25
5	2.1	2.5	2.4	3.2	4.1	5.85	6.25	4.05	2.2	2.0	2.35	2.2
6	2.1	2.65	2.4	3.1	4.2	6.15	6.5	3.8	2.2	2.0	2.45	2.3
7	2.0	2.85	2.45	3.05	4.25	6.4	6.5	3.6	2.2	2.1	2.45	2.3
8	2.0	2.8	2.45	3.0	4.25	6.35	6.35	3.5	2.1	2.15	2.3	2.25
9	2.1	2.8	2.3	2.95	4.05	5.0	6.05	3.4	2.0	2.15	2.25	2.2
10	2.1	2.6	2.3	3.0	3.95	5.6	6.0	3.35	1.85	2.2	2.3	2.3
11	2.1	2.45	2.15	3.25	3.9	5.35	5.95	3.35	1.7	2.2	2.4	2.3
12	2.1	2.5	1.9	3.5	4.15	5.35	5.8	3.2	1.55	2.25	2.4	2.35
13	2.1	2.5	1.7	3.8	4.25	5.6	5.6	3.1	1.5	2.1	2.3	2.4
14	2.05	2.5	1.8	4.05	4.1	5.5	5.7	3.0	1.4	2.0	2.3	2.4
15	2.1	2.5	1.8	4.3	3.95	5.1	5.6	3.0	1.5	1.95	2.25	2.3
16	2.1	2.45	1.85	4.25	3.85	4.8	5.5	3.1	1.5	1.9	2.2	2.3
17	2.1	2.4	1.95	4.0	3.85	4.55	5.4	3.1	1.5	1.9	2.2	2.3
18	2.1	2.4	2.25	3.8	4.05	4.35	5.35	3.2	1.45	1.9	2.25	2.2
19	1.9	2.4	4.0	3.9	4.25	4.15	5.15	3.25	1.45	2.0	2.25	2.2
20	1.9	2.35	5.6	4.0	4.5	4.1	4.95	3.05	1.55	2.05	2.3	2.2
21	2.0	2.3	6.15	4.1	4.75	4.15	4.9	2.9	1.6	2.15	2.2	2.2
22	1.9	2.25	5.1	4.1	4.85	4.4	4.75	2.95	1.6	2.2	2.2	2.2
23	1.95	2.3	4.15	4.0	4.65	4.75	4.6	2.75	1.5	2.3	2.2	2.1
24	2.1	2.3	3.7	4.05	4.45	4.9	4.55	2.55	1.5	2.4	2.2	2.15
25	2.25	2.3	3.4	4.2	4.15	4.8	4.65	2.5	1.5	2.4	2.2	2.2
26	2.3	2.25	3.25	4.1	4.15	4.55	4.7	2.45	1.4	2.4	2.2	2.3
27	2.3	2.2	3.15	4.1	4.25	4.4	4.8	2.25	1.4	2.4	2.2	2.35
28	2.35	2.25	3.1	4.0	4.25	4.5	4.75	2.35	1.5	2.5	2.3	2.4
29	2.2	.....	2.95	3.95	4.15	4.8	4.7	2.4	1.65	2.4	2.3	2.4
30	2.3	.....	2.9	3.9	4.35	5.2	4.55	2.45	1.85	2.5	2.2	2.4
31	2.4	.....	2.95	.....	4.5	.....	4.35	2.4	.....	2.55	.....	2.3

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1908.								1908.							
1	2.3	2.3	2.4	1.8	1.25	1.55	0.95	16	2.2	2.15	2.45	1.4	0.8	2.25	0.5
2	2.3	2.3	2.5	1.75	1.55	1.55	1.25	17	2.25	2.2	2.55	1.45	.8	1.95	.45
3	2.2	2.25	2.55	1.7	1.65	1.5	1.3	18	2.3	2.2	2.85	1.5	.9	1.7	.3
4	2.2	2.25	2.5	1.6	1.55	1.45	1.2	19	2.3	2.2	2.95	1.35	.9	1.25	.45
5	2.2	2.3	2.35	1.5	1.35	1.35	1.3	20	2.2	2.1	3.0	1.3	.85	1.05	.65
6	2.2	2.25	2.3	1.45	1.15	1.35	1.15	21	2.2	2.15	2.9	1.15	.9	1.05	.75
7	2.1	2.2	2.3	1.35	1.0	1.15	1.1	22	2.2	2.2	2.8	1.15	1.05	1.0	.55
8	2.15	2.25	2.3	1.15	1.15	1.0	1.0	23	2.25	2.2	2.75	1.3	1.35	1.0	.45
9	2.2	2.3	2.3	1.0	1.45	.95	1.0	24	2.3	2.25	2.6	1.15	1.4	1.0	.25
10	2.25	2.2	2.2	1.05	1.35	.95	.9	25	2.3	2.3	2.45	1.05	1.3	1.0	.2
11	2.3	2.2	2.2	1.1	1.15	1.15	1.0	26	2.3	2.3	2.3	.85	1.3	1.0	.2
12	2.3	2.2	2.2	1.15	1.05	1.35	1.0	27	2.3	2.3	2.3	.45	1.4	.9	.2
13	2.25	2.1	2.2	1.2	.95	1.6	.95	28	2.3	2.35	2.2	.2	1.4	.9	.25
14	2.2	2.1	2.2	1.25	.95	1.9	.75	29	2.3	2.4	2.05	.35	1.35	.85	.3
15	2.2	2.1	2.3	1.35	.85	2.2	.65	30	2.3	.....	2.0	.85	1.35	.85	.3
								31	2.3	.....	1.9	.....	1.4	.....	.4

Daily discharge, in second-feet, of Walker River near Wabuska, Nev., for 1906 and 1907.

Day.	1906.					1907.		
	May.	June.	July.	Aug.	Sept.	June.	July.	Aug.
1	370	540	2,470	1,870	220	950	1,970	1,220
2	350	530	2,350	1,710	210	1,110	2,410	1,150
3	380	500	2,430	1,460	210	1,330	2,650	1,150
4	460	480	2,550	1,350	205	1,510	2,540	1,080
5	540	550	2,700	1,190	180	1,810	2,620	940
6	670	720	2,880	1,150	180	2,040	2,810	790
7	900	830	3,120	1,060	155	2,250	2,810	670
8	1,150	760	3,080	1,020	130	2,210	2,700	610
9	1,180	690	3,200	1,020	105	1,190	2,460	560
10	1,290	690	3,270	950	95	1,620	2,560	540
11	1,470	970	3,240	925	90	1,430	2,530	540
12	1,630	1,300	3,040	925	90	1,430	2,410	470
13	1,560	1,630	2,800	895	90	1,620	2,250	420
14	1,430	1,930	2,780	895	100	1,550	2,330	375
15	1,360	2,210	2,880	895	100	1,250	2,250	375
16	1,360	2,250	2,920	685	100	1,040	2,170	420
17	1,240	2,250	2,900	605	100	880	2,040	420
18	1,010	2,400	2,710	595	100	890	2,000	470
19	950	2,470	2,680	580	115	765	1,850	490
20	950	2,570	2,510	630	125	735	1,700	400
21	1,090	2,600	2,310	660	135	765	1,660	335
22	1,160	2,610	2,220	630	135	915	1,550	355
23	1,160	2,610	2,200	580	135	1,150	1,440	285
24	1,050	2,670	2,480	550	135	1,260	1,360	215
25	920	2,700	2,850	475	135	1,330	1,430	200
26	800	2,610	2,930	415	135	1,150	1,470	190
27	760	2,800	2,880	365	135	1,050	1,550	135
28	700	2,760	2,850	330	135	1,120	1,510	160
29	700	2,690	2,820	290	125	1,330	1,470	175
30	700	2,600	2,450	280	125	1,620	1,320	190
31	670	.....	2,000	250	.....	.....	1,180	175

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Walker River near Wabuska, Nev., for 1906 and 1907.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
May	1,630	350	966	0.399	0.46	59,400	C.
June	2,800	480	1,760	.727	.81	105,000	C.
July	3,270	2,000	2,730	1.13	1.30	168,000	C.
August	1,870	250	814	.336	.39	50,100	C.
September	220	90	134	.055	.06	7,970	C.
1907.							
June	2,250	735	1,310	.541	.60	78,000	C.
July	2,810	1,180	2,030	.839	.97	125,000	C.
August	1,220	135	500	.207	.24	30,700	D.

NOTE.—No estimates for remaining months of 1906 to 1908 could be made on account of shifting channel conditions and lack of measurements.

WEST FORK OF WALKER RIVER NEAR COLEVILLE, CAL.

This station, which was established October 5, 1902, to determine the total flow of the river above all diversions and to obtain for the

Reclamation Service reliable data concerning storage and irrigation opportunities, was discontinued July 31, 1908. The data were also used by the Nevada state engineer in adjusting water rights in Smith and Antelope valleys.

The cable was located about 1 mile east of the point where the main road from Topaz to Bridgeport crosses Lost Canyon Creek and is 600 feet from the road. The gage was about one-half mile above the cable.

The gage datum remained unchanged during the continuance of the station. The channel is permanent, the flow is apparently unaffected by ice or artificial control, and the record is good.

Discharge measurements of West Fork of Walker River near Coleville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 11	E. A. Porter	62	227	4.20	1,570
July 10	do	65	268	4.75	1,980
August 4	do	57	162	3.65	1,000
August 25	do	51	109	2.80	440
1908.					
March 28	E. A. Porter	51	76	1.80	170
April 17	do	52	120	2.60	359

Daily gage height, in feet, of West Fork of Walker River near Coleville, Cal., for 1907 and 1908.

[J. S. Trumble, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.4	1.4	1.6	2.2	3.3	4.95	5.85	3.8	2.4	1.9	1.8	1.4
2	1.3	1.4	1.5	2.1	3.3	5.1	5.85	3.7	2.4	1.8	1.7	1.4
3	1.3	1.5	1.5	2.0	3.3	5.4	5.9	3.6	2.4	1.8	1.7	1.5
4	1.3	1.6	1.6	2.0	3.4	5.45	5.85	3.4	2.4	1.8	1.7	1.5
5	1.3	1.8	1.6	2.0	3.5	5.3	5.8	3.4	2.4	1.8	1.7	1.5
6	1.3	1.8	1.6	2.0	3.4	5.3	5.75	3.4	2.4	1.8	1.7	1.5
7	1.3	1.8	1.6	2.0	3.2	4.9	5.6	3.3	2.4	1.8	1.7	1.5
8	1.4	1.7	1.6	2.0	3.1	4.5	5.3	3.2	2.4	1.8	1.7	1.5
9	1.4	1.7	1.6	2.1	3.2	4.35	4.8	3.1	2.4	1.8	1.7	1.5
10	1.4	1.6	1.6	2.2	3.3	4.3	4.75	3.1	2.4	1.8	1.7	1.5
11	1.4	1.6	1.6	2.4	3.5	4.4	4.75	3.0	2.4	1.8	1.7	1.6
12	1.4	1.6	1.7	2.3	3.5	4.1	4.65	3.0	2.4	1.8	1.7	1.6
13	1.4	1.6	1.7	2.7	3.5	4.05	4.65	3.1	2.4	1.8	1.7	1.6
14	1.3	1.6	1.8	3.2	3.5	3.45	4.6	3.2	2.3	1.7	1.6	1.5
15	1.3	1.6	1.8	3.2	3.5	3.4	4.45	3.3	2.3	1.7	1.6	1.5
16	1.3	1.6	1.8	3.2	3.6	3.2	4.45	3.4	2.3	1.7	1.6	1.5
17	1.3	1.6	2.9	3.1	3.7	2.85	4.4	3.4	2.2	1.7	1.6	1.5
18	1.3	1.5	3.8	3.1	3.9	2.9	4.35	3.4	2.1	1.7	1.8	1.5
19	1.3	1.5	4.1	3.0	4.1	3.1	4.35	3.3	2.1	1.7	1.7	1.5
20	1.4	1.5	3.9	3.1	4.0	3.2	4.2	3.2	2.0	1.7	1.6	1.5
21	1.4	1.6	3.7	3.2	4.0	3.35	4.2	3.1	2.0	1.7	1.6	1.6
22	1.4	1.6	3.5	3.2	4.0	3.45	4.25	2.9	2.0	1.7	1.6	1.6
23	1.4	1.6	3.1	3.2	4.0	4.05	4.25	2.8	2.0	1.7	1.6	1.5
24	1.4	1.5	2.4	3.2	3.9	3.95	4.4	2.7	2.0	1.7	1.6	1.5
25	1.4	1.5	2.0	3.3	3.9	4.2	4.35	2.7	1.9	1.7	1.6	1.5
26	1.4	1.6	2.0	3.3	3.9	4.35	4.35	2.6	1.9	1.8	1.5	1.5
27	1.4	1.6	2.1	3.3	3.9	4.7	4.35	2.6	1.9	1.9	1.5	1.5
28	1.5	1.6	2.1	3.3	3.9	5.2	4.45	2.6	1.9	1.9	1.5	1.6
29	1.5	.....	2.2	3.3	3.9	5.6	4.2	2.5	1.8	1.8	1.5	1.6
30	1.5	.....	2.3	3.3	4.1	5.5	4.0	2.5	1.8	1.8	1.4	1.5
31	1.4	.....	2.2	.....	4.6	.....	3.9	2.5	.....	1.8	.....	1.5

Daily gage height, in feet, of West Fork of Walker River near Coleville, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1908.								1908.							
1....	1.5	1.4	1.3	2.0	3.3	2.9	3.0	16....	1.5	1.5	1.8	2.7	2.6	3.2	2.5
2....	1.5	1.4	1.3	2.0	3.2	3.0	3.1	17....	1.5	1.6	1.9	2.6	2.5	3.2	2.5
3....	1.5	1.4	1.3	2.0	3.0	2.9	3.1	18....	1.5	1.7	2.0	2.6	2.5	3.1	2.5
4....	1.5	1.4	1.3	2.1	2.8	2.8	3.1	19....	1.5	1.6	2.0	2.4	2.6	3.1	2.5
5....	1.5	1.4	1.3	2.2	2.7	2.9	3.1	20....	1.5	1.5	2.0	2.1	2.6	2.9	2.5
6....	1.5	1.3	1.3	2.2	2.9	3.0	3.1	21....	1.5	1.5	2.1	2.0	2.6	2.8	2.4
7....	1.5	1.3	1.3	2.0	3.1	3.2	3.0	22....	1.5	1.4	2.1	1.8	2.7	2.8	2.4
8....	1.5	1.3	1.3	2.0	2.9	3.4	3.1	23....	1.4	1.4	2.1	1.7	2.9	2.9	2.4
9....	1.5	1.3	1.4	2.0	2.7	3.4	3.0	24....	1.4	1.4	2.2	2.0	3.0	3.0	2.4
10....	1.6	1.3	1.5	2.1	2.7	3.4	2.9	25....	1.5	1.4	2.2	2.5	3.2	3.1	2.4
11....	1.6	1.3	1.5	2.2	2.6	3.5	2.9	26....	1.5	1.4	2.1	2.6	3.2	3.1	2.5
12....	1.6	1.3	1.6	2.5	2.6	3.5	2.8	27....	1.5	1.4	2.0	2.8	3.2	3.2	2.5
13....	1.5	1.3	1.7	2.7	2.6	3.6	2.8	28....	1.5	1.4	2.0	3.0	3.1	3.2	2.5
14....	1.5	1.4	1.7	2.8	2.6	3.5	2.7	29....	1.5	1.3	1.9	3.1	3.4	3.1	2.4
15....	1.5	1.5	1.8	2.7	2.9	3.3	2.6	30....	1.4	.....	2.0	3.2	3.4	3.0	2.5
								31....	1.4	.....	2.0	.....	3.1	.....	2.4

Rating table for West Fork of Walker River near Coleville, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	85	2.40	330	3.50	960	4.60	2,240
1.40	100	2.50	365	3.60	1,050	4.70	2,380
1.50	116	2.60	405	3.70	1,140	4.80	2,520
1.60	133	2.70	445	3.80	1,240	4.90	2,670
1.70	151	2.80	490	3.90	1,350	5.00	2,820
1.80	170	2.90	540	4.00	1,470	5.20	3,120
1.90	190	3.00	600	4.10	1,590	5.40	3,420
2.00	210	3.10	660	4.20	1,710	5.60	3,720
2.10	235	3.20	720	4.30	1,840	5.80	4,020
2.20	255	3.30	790	4.40	1,970	6.00	4,320
2.30	295	3.40	870	4.50	2,100		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on 40 discharge measurements made during 1903 to 1908. It is well defined below gage height 2.2 feet and fairly well above.

Monthly discharge of West Fork of Walker River near Coleville, Cal., for 1907 and 1908.

[Drainage area, 306 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	116	85	95.7	0.313	0.36	5,880	B.
February	170	100	132	.431	.45	7,330	B.
March	1,590	116	380	1.24	1.43	23,400	B.
April	790	210	523	1.71	1.91	31,100	B.
May	2,240	660	1,150	3.76	4.34	70,700	B.
June	3,720	515	1,960	6.41	7.15	117,000	B.
July	4,170	1,350	2,480	8.11	9.35	152,000	B.
August	1,240	365	685	2.24	2.58	42,100	B.
September	330	170	269	.879	.98	16,000	B.
October	190	151	165	.539	.62	10,100	A.
November	170	100	140	.458	.51	8,330	A.
December	133	100	119	.389	.45	7,320	B.
The year	4,170	85	675	2.21	30.13	491,000	
1908.							
January	133	100	116	.379	.44	7,130	B.
February	151	85	102	.333	.36	5,870	B.
March	265	85	165	.539	.62	10,100	A.
April	720	151	336	1.10	1.23	20,000	B.
May	870	365	548	1.79	2.06	33,700	B.
June	1,050	490	693	2.26	2.52	41,200	B.
July	660	330	469	1.50	1.73	28,309	B.
The period						146,000	

NOTE.—The open channel rating has been applied throughout; gage heights for the winter periods do not seem be affected by ice conditions.

OWENS RIVER BASIN.

Owens River rises in the Sierra Nevada in eastern California and flows southeastward parallel with this range, finally discharging its waters into Owens Lake. Its basin, which lies between the Sierra Nevada on the west and the White Mountains on the east, has a length from north to south of approximately 150 miles and a width of from 20 to 25 miles. Practically the entire flow of the river is derived from the Sierra Nevada, as it drains the eastern slope of this range from Mount Lyell on the north to a point some distance below Mount Whitney on the south.

The results of data collected in the Owens River valley in 1907–8 are contained in Water Supply Paper 251, which presents the results of all river discharge data collected in California during 1907–8.

GREAT BASIN DRAINAGE AREA IN OREGON.

DESCRIPTION.

The Great Basin drainage area in Oregon comprises about one-fourth of the State. The surface waters throughout this area drain into the natural depressions in the ground, the water either evaporating or, if the flow is sufficient, forming perennial lakes. The area is generally high and rolling. Forests, except on the borders of the basin, are small. The soil is rough, sparsely covered with grass, and is given largely to range for sheep and cattle. The rainfall throughout the basin is about 10 inches per annum.

The principal lakes are Harney, Malheur, Warner, Summer, Silver, Christmas, Goose, and Abert. With the exception of Silver Lake all are alkaline. The surface waters of this basin are very valuable for irrigation, but unfortunately are insufficient in quantity. The irrigated valley lands contiguous to the streams have been taken, and the low-water flow of the principal streams is entirely used.

The general elevation of the Great Basin in Oregon is between 4,000 and 5,000 feet. The ridges of mountains which form the rim of this basin have an approximate elevation of 7,000 feet. At Burns the elevation is 4,185; Silver Lake post-office, 4,380; Lake Abert, 4,209; and Warner Lake, 4,544.

Irrigation is almost an absolute necessity for growing anything except the hardier wheats, which have been raised with more or less success by the dry-farming process. Any extensive irrigation development will necessitate the investment of large sums of money in storage reservoirs and canal systems.

The principal streams of this basin, classified by the lakes into which they flow, are as follows: Silvies River, discharging into Malheur Lake; Donner and Blitzen River, draining the western slope

of Steins Mountain and flowing north into Malheur Lake; Silver Creek into Harney Lake; Silver, Bridge, and Bear creeks into Silver Lake; Summer Creek and Ana River into Summer Lake; and Chewaucan River into Lake Abert.

Silver Creek, in Lake County, drains the divide between the Great Basin and Klamath River drainage, flowing northward into Paulina Marsh and thence into Silver Lake, from which at high stages it overflows onto the Silver Lake Desert. From the same divide Bear Creek and Bridge Creek flow into Paulina Marsh. Ana River is a small stream, about 1½ miles long, which empties into Summer Lake, a strongly alkaline body of water. The waters of Ana River are warm and of excellent quality, as they come from subterranean depths through five large springs. The temperature of the water winter and summer is about 62° and the combined flow of the springs is about 145 second-feet. Chewaucan River rises on the opposite side of the divide from Sprague River and flows north through Chewaucan Marsh into Lake Abert.

The following gaging stations have been maintained in this drainage basin:

Silvies River near Burns, Oreg., 1903–1906 and 1908.
Silvies River near Silvies, Oreg., 1903–1905.
Silver Creek (Harney County) near Riley, Oreg., 1904–1906 and 1908.
Silver Creek (Lake County) near Silver Lake, Oreg., 1904–1907.
Bridge Creek near Silver Lake, Oreg., 1905–6.
Bear Creek near Silver Lake, Oreg., 1905–6.
Ana River near Summer Lake, Oreg., 1905.
Chewaucan River near Paisley, Oreg., 1905–1907.

In addition to these gaging stations, a few records of lake heights have been kept in Silver Lake, Summer Lake, Harney Lake, and Malheur Lake. For several of these stations, which were reestablished the latter part of December, 1908, the data are withheld until the 1909 report.

SILVER CREEK NEAR SILVER LAKE, OREG.

This station, which is located 1½ miles southwest of Silver Lake post-office, 3 miles below the mouth of the West Fork of Silver Creek, in sec. 28, T. 28 N., R. 14 E., was established December 29, 1904, at the time the Silver Lake project was under investigation by the United States Reclamation Service. The present flow of the creek during the irrigating season is entirely appropriated for irrigation, and any additional development will involve the construction of storage reservoirs.

Ice interferes with the observations during the winter months. The conditions at the station, however, are favorable for good results during the open season. Owing to lack of funds the station was

abandoned March 31, 1907, but observations were again resumed January 11, 1909. No measurements were made during 1907.

Daily gage height, in feet, of Silver Creek near Silver Lake, Oreg., for 1907

[Henry Egle, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	0.7	1.5	2.4	11	1.1	2.8	1.2	21	1.2	2.5	5.0
2	.75	1.55	2.2	12	1.1	2.7	1.0	22	1.3	2.95	4.2
3	.8	2.8	2.0	13	1.1	2.4	1.1	23	1.3	2.9	2.2
4	.9	3.1	1.1	14	1.0	2.2	1.1	24	1.3	2.9	2.2
5	.85	5.0	1.1	15	1.0	2.2	1.6	25	1.3	3.0	2.3
6	.85	5.7	1.1	16	1.1	2.2	1.3	26	1.4	3.0	2.2
7	.85	4.1	1.5	17	1.1	2.2	2.2	27	1.4	2.9	2.1
8	.85	3.0	1.8	18	1.1	2.1	3.4	28	1.45	2.2	2.2
9	.9	2.6	1.6	19	1.1	2.2	5.1	29	1.45	.....	2.2
10	1.0	3.0	1.2	20	1.2	2.4	9.08	30	1.45	.....	2.2
								31	1.5	.....	2.8

NOTE.—Observer made no ice notes. The 1906 rating probably applies for these gage heights.

CHEWAUCAN RIVER AT PAISLEY, OREG.

This station, which was established January 4, 1905, is one-half mile above Paisley, 500 feet above Conn's mill ditch. George Conn's irrigation ditch diverts water from the left bank of the stream 2½ miles above the gaging station.

The results are of considerable value in connection with irrigation projects. The Chewaucan project was under investigation by the United States Reclamation Service in 1904 and 1905, but the data concerning the water supply were insufficient and construction has not yet been authorized. Since that time the State has entered into contract with private parties for the reclamation of about 12,000 acres to the north and west of Paisley. Owing to the inaccessibility of the station and the lack of funds the station was abandoned December 10, 1907, but observations were again resumed January 17, 1909.

The conditions at the station are favorable for good results during the open season. The channel is not stable during floods, and the high waters during April, 1907, so modified the channel that the old rating curve was not applicable and no estimates have been possible since that date. No measurements were made during 1907.

Daily gage height, in feet, of Chewaucan River at Paisley, Oreg., for 1907.

[Lula Banister, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	5.0	4.9	.....	6.5	6.9	5.2	3.9	3.7	3.8	3.8	3.5
2	4.0	7.25	4.6	.....	6.4	6.8	5.0	3.9	3.8	3.7	3.7	.....
3	3.8	6.9	4.5	.....	6.4	6.6	5.0	3.9	3.6	3.6	3.7	.....
4	3.7	7.65	4.6	.....	6.4	6.7	5.0	3.9	3.7	3.6	3.6	.....
5	3.9	7.0	4.6	.....	6.3	6.6	5.0	3.9	3.8	3.6	3.6	.....
6	3.8	6.4	4.6	.....	6.4	6.8	5.0	3.8	3.7	3.6	3.6	.....
7	3.6	6.0	4.6	.....	6.3	6.9	4.9	3.7	3.6	3.6	3.6	.....
8	4.9	5.5	4.6	.....	6.3	6.7	4.7	.....	3.5	3.5	3.6	3.6
9	5.0	5.4	4.6	.....	6.6	6.6	4.6	3.6	3.5	3.5	3.6	3.6
10	5.1	5.2	4.6	7.0	6.8	6.0	4.5	3.6	3.5	3.5	3.6	3.6
11	5.0	5.0	4.5	7.0	6.8	6.9	4.5	3.6	3.5	3.6	3.6	3.7
12	4.1	5.0	4.3	7.0	6.5	6.9	4.5	3.6	3.5	3.8	3.6	3.8
13	4.3	4.9	4.3	7.0	6.5	.....	4.4	3.5	3.5	3.7	3.6	3.8
14	4.4	4.9	4.2	7.0	6.4	6.3	.....	3.5	3.5	3.6	3.6	.....
15	4.6	4.9	4.3	6.9	6.3	5.9	4.3	3.5	3.5	3.6	3.6	.....
16	4.4	4.9	4.4	6.8	6.8	5.8	4.2	3.5	3.5	3.6	3.6	.....
17	4.3	4.9	5.0	6.6	6.8	5.7	.....	3.4	3.5	3.6	3.5	.....
18	4.2	4.9	6.8	6.5	7.0	5.6	4.1	3.4	3.5	3.6	3.6	.....
19	4.3	4.9	6.7	6.5	7.5	5.5	4.1	3.4	3.6	3.5	3.6	.....
20	4.4	4.9	5.7	6.4	7.0	6.0	4.0	3.4	3.6	3.6	3.6	.....
21	4.3	4.9	5.5	6.4	6.8	5.9	4.0	3.4	3.6	3.6	3.6	.....
22	4.2	5.0	5.3	6.5	6.5	5.8	4.1	3.4	3.6	3.6	3.7	.....
23	4.1	5.1	5.3	6.6	6.5	5.6	4.2	3.4	3.6	3.6	3.7	.....
24	4.2	5.2	5.3	6.7	6.5	5.4	4.1	3.4	3.5	3.6	3.7	.....
25	4.3	5.2	5.3	6.6	6.4	5.4	4.0	3.5	3.5	3.8	3.7	.....
26	4.4	5.3	5.2	6.7	6.5	5.3	4.0	3.5	3.5	3.8	3.7	.....
27	4.5	4.7	5.0	6.6	6.6	5.3	4.0	3.5	3.5	3.8	3.7	.....
28	.....	4.9	5.3	6.5	6.7	5.3	4.0	3.5	.....	3.9	3.7	.....
29	4.3	.....	5.3	6.6	6.9	5.2	4.0	3.5	3.9	3.9	3.7	.....
30	4.4	.....	5.4	6.4	6.9	5.0	3.9	3.5	3.8	3.8	3.6	.....
31	4.6	.....	5.3	.....	6.6	.....	3.9	3.6	.....	3.8	.....	.....

NOTE.—The river was frozen January 1 to February 1, the ice reaching a thickness of about 6 inches.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the Great Basin drainage area during 1907 and 1908:

Miscellaneous measurements in Great Basin drainage area, in 1907 and 1908.

WASATCH MOUNTAINS DRAINAGE AREA.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
October 29, 1908	Spanish Fork	Utah Lake	Above Diamond Fork	44.6
Do	do	do	Opposite Castella Hot Springs	59.4
Do	do	do	Half mile above U. S. Reclamation Service diversion dam.	89.6
November 6, 1908	do	do	At U. S. Reclamation Service diversion dam.	81.2

SIERRA NEVADA DRAINAGE AREA.

May 21, 1908	Carson River	Carson Sink	Towle's ranch, between Empire and Canal chute stations.	554

Miscellaneous measurements in Great Basin drainage area in 1907 and 1908—Continued.

GREAT BASIN DRAINAGE AREA IN OREGON.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
August 13, 1908	Donner and Blitzen River.	Malheur Lake.	Mouth	7.0
August 28, 1907	do	do	"P" ranch	45.0
August 29, 1908	do	do	do	60.0
September 18, 1908	do	do	do	42.0
August 24, 1907	Kieger Creek	Blitzen River	Diamond post-office	9.0
August 27, 1907	McCoy Creek	Kieger Creek	2 miles above Diamond ranch.	3.5
Do	Krumbo Creek	Blitzen River	Near mouth	5.5
August 30, 1907	Bridge Creek	do	3 miles northeast of "P" ranch	12.0
August 26, 1907	Smyth Creek	Bartow Lake	3 miles above mouth	1.2
September 1, 1907	Home Creek		Drains southwest side Steens Mountain.	3.0
August 31, 1907	Roaring Springs		Southwest base Steens Mountain.	5.0
September 2, 1907	Threemile Creek		Drains southwest side Steens Mountain.	4.5
September 6, 1907	Skull Creek		do	5.0
September 9, 1907	Trout Creek	Alvord Lake	Mouth of canyon	1.3
September 10, 1907	Willow Creek	Small lake east of Alvord Lake.	5 miles southwest of White House ranch.	1.4
September 13, 1907	Alvord Creek		Drains east side Steens Mountain.	2.0
October 11, 1908	Bear Creek	Silver Lake (Lake County).	Hay's ranch	5.0
Do	Bridge Creek	do	Owsley's ranch	3.0
October 8, 1908	Silver Creek	Silver Lake	Silver Lake post-office	7.0
October 10, 1908	do	do	do	7.0
October 13, 1908	Chewaucan	Abert Lake	Paisley	25.0
Do	Drainage Canal C. L. and P. Co.	Chewaucan River	do	15.0
August 17, 1908	Silver Creek	Harney Lake	25 miles west of Riley	.5

INDEX.

A. Page.

Accuracy, degree of 24–25
Acknowledgments to those aiding 26
Acre-foot, definition of 11
Alvord Creek at—
  Steens Mountain, Oregon:
    discharge 143
Appropriations, amount of 5
Authority for investigations, recital of 5

B.

Bear Creek at—
  Hay's ranch, Oregon:
    discharge 143
Bear River at or near—
  Collinston, Utah:
    description 37–38
    discharge 38
    discharge, monthly 40
    gage heights 38–39
    rating table 39
  Dingle, Idaho:
    description 31
    discharge 31
    discharge, monthly 33
    gage heights 31–32
    rating tables 32–33
  Preston, Idaho:
    description 33–34
    discharge 34
    discharge, monthly 36–37
    gage heights 34–35
    rating tables 36
Bear River basin:
    description 29
    gaging stations 30
    stream flow 31–51
Blacksmith Fork near—
  Hyrum, Utah:
    description 47–48
    discharge 48
    discharge, monthly 51
    gage heights 48–49
    rating tables 49
Blacksmith Fork power-plant race near—
  Hyrum, Utah:
    description 47
    discharge 50
    gage heights 50–51
    rating table 51
Bridge Creek at or near—
  Owsley's ranch, Oregon:
    discharge 143
  P ranch, Oregon:
    discharge 143
Brunswick Mill canal near— Page.
  Empire, Nev.:
    description 123
    discharge 126
    discharge, monthly 127
    gage heights 127
Burridge, G. T., work of 26

C.

California-Nevada state line. *See* Nevada-California state line.
Carson river basin:
    description 121
    gaging stations 121
    stream flow 121–130
Carson River near—
  Empire, Nev.:
    description 123
    discharge 124
    discharge, monthly 126
    gage heights 124–125
    rating tables 125
  Hazen, Nev.:
    description 127–128
    discharge 128
    gage heights 128
  Towle's ranch, Nev.:
    discharge 142
Carson River (East Fork) near—
  Gardnerville, Nev.:
    description 121–122
    discharge 122
    discharge, monthly 123
    gage heights 122
    rating table 122
Carson River (West Fork) near—
  Woodfords, Cal.:
    description 128
    discharge 129
    discharge, monthly 130
    gage heights 129–130
    rating table 130
Castella Hot Springs, Utah:
  Spanish Fork at:
    discharge 142
Chewaucan River at—
  Paisley, Oreg.:
    description 141
    discharge 143
    gage heights 142
C., L. & P. Company canal at—
  Paisley, Oreg.:
    discharge 143

Page.
Coleville, Cal.,
Walker River (West Fork) near:
description 136–137
discharge 137
discharge, monthly 138
gage heights 137–138
rating table 138
Collinston, Utah,
Bear River near:
description 37–38
discharge 38
discharge, monthly 40
gage heights 38–39
rating table 39
Computing, office methods of 19–24
Cooperation, credit for 26
Croydon, Utah,
Weber River near:
description 56
discharge 56
discharge, monthly 58
gage heights 57
rating tables 58
Current meter, description of 17–18
use of 16, 18–19
views of 18
Current-meter stations, views of 16
Curves, discharge, figure showing 21

D.

Definitions, statements of terms used 11
Derby dam, Nev.,
Truckee River at:
description 110
discharge 111
discharge, monthly 112
gage heights 111–112
rating table 112
Diamond, Oreg.,
Keiger Creek at:
discharge 143
Diamond Fork, Utah,
Spanish Fork near:
discharge 142
Diamond Fork near
Thistle, Utah:
description 78
discharge 78
discharge, daily 79
discharge, monthly 79
gage heights 78
Diamond ranch, Oregon,
McCoy Creek near:
discharge 143
Dingle, Idaho,
Bear River at:
description 31
discharge 31
discharge, monthly 33
gage heights 31–32
rating tables 32–33
Discharge, computation of 19–24
curves for 21
figure showing 21
measurement of 21
Discharge measurements, nature of 13, 14

Page
Donner and Blitzen River at—
mouth:
discharge 143
P ranch:
discharge 143
Donner Creek near—
Truckee, Cal.:
description 113
discharge 113
discharge, monthly 115
gage heights 113–114
rating tables 114–115
Drainage, stream flow and 7–8
Drainage basins, list of 8

E.

Elburz, Nev., Humboldt River (North Fork) near. *See* Halleck, Nev.
Elko, Nev.,
Humboldt River (South Fork) near:
description 96
discharge 97
discharge, monthly 99
gage heights 97–98
rating tables 98–99
Empire, Nev.,
Brunswick Mill canal near:
description 123
discharge 126
discharge, monthly 127
gage heights 127
Carson River near:
description 123
discharge 124
discharge, monthly 126
gage heights 124–125
rating tables 125
Equivalents, list of 12–13

F.

Field practice, methods of 14–19
Float method, description of 17
Flood prevention, stream flow and 8
Fuller, E. S., work of 26

G.

Gage heights, nature of 13
Gaging stations, classification of 20–25
description of 16
Gardnerville, Nev.,
Carson River (East Fork) near:
description 121–122
discharge 122
discharge, monthly 123
gage heights 122
rating table 122
Golconda, Nev.,
Humboldt River near:
description 87
discharge 87
discharge, monthly 90
gage heights 88
rating tables 89

Great Basin: Page.
description 26–28
miscellaneous measurements 142–143
stream flow 31–142
Gunnison, Utah,
Sevier River near:
description 83
discharge 83
discharge, monthly 85
gage heights 84
rating table 85

H.

Halleck, Nev.,
Humboldt River (North Fork) near:
description 93
discharge 93
discharge, monthly 96
gage heights 94
rating table 95
Hay's ranch, Oregon,
Bear Creek at:
discharge 143
Hazen, Nev.,
Carson River near:
description 127–128
discharge 128
gage heights 128
Henshaw, F. F., work of 26
Hobart Mills, Cal.,
Prosser Creek near:
description 115–116
discharge 116
discharge, monthly 117
gage heights 116
rating table 117
Hobble Creek basin:
description 67–68
gaging station 68
stream flow 68–70
Hobble Creek near—
Springsville, Utah:
description 68
discharge 68
discharge, monthly 70
gage heights 68–69
rating table 70
Home Creek at—
Steens Mountain, Oregon:
discharge 143
Humboldt River near—
Golconda, Nev.:
description 87
discharge 87
discharge, monthly 90
gage heights 88
rating tables 89
Oreana, Nev.:
description 90
discharge 90
discharge, daily 92
discharge, monthly 93
gage heights 91
rating tables 92
Humboldt River (North Fork) near—
Halleck, Nev.:
description 93
discharge 93
Humboldt River (North Fork) near—Con. Page.
Halleck, Nev.—Continued.
discharge, monthly 96
gage heights 94
rating tables 95
Humboldt River (South Fork) near
Elko, Nev.:
description 96
discharge 97
discharge, monthly 99
gage heights 97–98
rating tables 98–99
Humboldt Sink basin:
description 86
gaging stations 86–87
stream flow 87–99
Hyrum, Utah,
Blacksmith Fork near:
description 47–48
discharge 49
discharge, monthly 51
gage heights 48–49
rating table 49
Blacksmith Fork power-plant race near:
description 47
discharge 50
gage heights 50–51
rating table 51

I.

Ice, measurements under 19, 24
Investigations, authority for 5
purposes of 7–8
scope of 6–7
Irrigation, stream flow and 7

K.

Kennedy, M. B., work of 26
Kieger Creek at—
Diamond, Oreg.:
discharge 143
Krumbo Creek near—
mouth:
discharge 143

L.

Lake Shore, Utah,
Spanish Fork near:
description 76
discharge 76
discharge, daily 77
discharge, monthly 77
gage heights 77
Lake Tahoe at—
Tahoe, Cal.:
description 101
gage heights 102
La Rue, E. C., work of 26
Little Truckee River at—
Pine Station, Cal.:
description 117
discharge 118
discharge, monthly 119
gage heights 118
rating tables 118–119
Starr, Cal.:
description 117
discharge 119

Little Truckee River at—Continued. Page.
Starr, Cal.—Continued.
discharge, monthly 120
gage heights 120
rating table 120
Logan, Hyde Park, and Smithfield canal near—
Logan, Utah:
description 45
discharge 45
discharge, monthly 47
gage heights 45–46
rating table 46
Logan River near—
Logan, Utah:
description 40–41
discharge 41
discharge daily 43
discharge, monthly 44
gage heights 41–42
rating tables 42–43

M.

McCoy Creek near—
Diamond ranch, Oregon:
discharge 143
Marysvale, Utah,
Sevier River near:
description 80
discharge 81
discharge, monthly 83
gage heights 81–82
rating table 82
Mathers, J. G., work of 26
Miner's inch, definition of 11
Miscellaneous measurements:
Great Basin in Oregon 143
Sierra Nevada area 142
Wasatch Mountains area 142

N.

Navigation, stream flow and 7
Nevada, cooperation of 26
Nevada-California state line,
Truckee River at:
description 105
discharge 105
discharge, monthly 107–108
gage heights 106
rating tables 107

O.

Oakley, Utah,
Weber River near:
description 53
discharge 54
discharge, monthly 55–56
gage heights 54–55
rating table 55
Office practice, method of 19–24
Oreana, Nev.,
Humboldt River near:
description 90
discharge 90
discharge, daily 92
Oreana, Nev.—Continued. Page.
Humboldt River near—Continued.
discharge, monthly 93
gage heights 91
rating tables 92
Oregon, Great Basin drainage in:
description 139–140
gaging stations 140
miscellaneous measurements 143
stream flow 140–142
Owens River basin:
description 139
Owsley's ranch, Oregon,
Bridge Creek at:
discharge 143

P.

Padgett, H. D., work of 26
Paisley, Oreg.,
Chewaucan River at:
description 141
discharge 143
gage heights 142
C., L. & P. Company canal at:
discharge 143
Parker, G. L., work of 26
Pine station, Cal.,
Little Truckee River at:
description 117
discharge 118
discharge, monthly 119
gage heights 118
rating tables 118–119
Plain City, Utah,
Weber River near:
description 59
discharge 59
discharge, monthly 61–62
gage heights 59–60
rating tables 60–61
Porter, E. A., work of 26
P ranch, Oregon,
Bridge Creek near:
discharge 143
Donner and Blitzen River at:
discharge 143
Preston, Idaho,
Bear River near:
description 33–34
discharge 34
discharge, monthly 36–37
gage heights 34–35
rating tables 36
Prosser Creek near—
Hobart Mills, Cal.:
description 115–116
discharge 116
discharge, monthly 117
gage heights 116
rating table 117
Provo River basin:
description 62–63
gaging stations 63
stream flow 63–67

Page.
Provo River near—
Provo, Utah (at mouth of canyon):
description 66
discharge, daily 67
discharge, monthly 67
rating table 66
Provo, Utah (above Telluride Power Co.'s dam):
description 63
discharge 63
discharge, monthly 65–66
gage heights 64
rating tables 65
Publications, lists of 8–11

R.

Rating curves, construction and use of 20
Rating tables, construction of 20
nature of 14
Reclamation Service, cooperation of 26
Revision, need for 25–26
Rice, R. C., work of 26
Riley, Oreg.,
Silver Creek near:
discharge 143
Roaring Springs, Oregon:
discharge 143
Run-off, computation of 19–24
definition of 11

S.

Second-foot, definition of 11
Section, changes in, estimation for 21–24
Sevier River basin:
description 79–80
gaging stations 80
stream flow 80–85
Sevier River near—
Gunnison, Utah:
description 83
discharge 83
discharge, monthly 85
gage heights 84
rating table 85
Marysvale, Utah:
description 80
discharge 81
discharge, monthly 83
gage heights 81–82
rating table 82
Sierra Nevada drainage:
miscellaneous measurements 142
principal streams 100
stream flow 100–139
Silver Creek near—
Riley, Oreg.:
discharge 143
Silver Lake, Oreg.:
description 140–141
discharge 143
gage heights 141
Silver Lake, Oreg.,
Silver Creek near:
description 140–141
discharge 143
gage heights 141

Page.
Skull Creek at—
Steens Mountain, Oregon:
discharge 143
Smyth Creek near—
mouth:
discharge 143
Spanish Fork at or near—
Castella Hot Springs, Utah:
discharge 142
Diamond Fork, Utah:
discharge 142
Lake Shore, Utah:
description 76
discharge 76
discharge, daily 77
discharge, monthly 77
gage heights 77
Reclamation Service dam, Utah:
discharge 142
Thistle, Utah:
description 71
discharge 71
discharge, monthly 73
gage heights 72
rating table 72
Spanish Fork, Utah:
description 73
discharge 73
discharge, monthly 75–76
gage heights 74
rating tables 75
Spanish Fork basin:
description 70–71
gaging stations 71
stream flow 71–79
Springville, Utah,
Hobble Creek near:
description 68
discharge 68
discharge, monthly 70
gage heights 68–69
rating table 70
Starr, Cal.,
Little Truckee River at:
description 117
discharge 119
discharge, monthly 120
gage heights 120
rating table 120
Steens Mountain, Oregon,
streams on:
discharge 143
Stevens, G. C., work of 26
Stevens, J. C., work of 26
Slope method, description of 14
Stream measurements, accuracy of 24–25
data of, use of 25–26
methods of 14–19
Swamps, drainage of, stream flow and 7–8

T.

Tables, explanation of 13–14
Tahoe, Cal.,
Lake Tahoe at:
description 101
gage heights 102

Tahoe, Cal.—Continued. Page.
Truckee River at:
description 103
discharge 103
discharge, monthly 105
gage heights 103-104
rating tables 104
Terms, definitions of 11
Thistle, Utah,
Diamond Fork near:
description 78
discharge 78
discharge, daily 79
discharge, monthly 79
gage heights 78
Spanish Fork at:
description 71
discharge 71
discharge, monthly 73
gage heights 72
rating table 72
Threemile Creek at—
Steens Mountain, Oregon:
discharge 143
Towle's ranch, Nev.,
Carson River at:
discharge 142
Trout Creek, Oregon:
discharge 143
Truckee, Cal.,
Donner Creek near:
description 113
discharge 113
discharge, monthly 115
gage heights 113-114
rating tables 114-115
Truckee River at—
Derby dam, Nev.:
description 110
discharge 111
discharge, monthly 112
gage heights 111-112
rating table 112
Nevada-California state line:
description 105
discharge 105
discharge, monthly 107-108
gage heights 106
rating tables 107
Tahoe, Cal.:
description 103
discharge 103
discharge, monthly 105
gage heights 103-104
rating tables 104
Vista, Nev.:
description 108
discharge 108
discharge, monthly 110
gage heights 109
rating table 109-110
Truckee River basin:
description 100-101
gaging stations 101
stream flow 101-120

U.

Utah, cooperation of 26

V. Page.

Velocity method, description of 15-19
Vista, Nev.,
Truckee River at:
description 108
discharge 108
discharge, monthly 110
gage heights 109
rating tables 109-110

W.

Wabuska, Nev.,
Walker River near:
description 134
discharge 134
discharge, daily 136
discharge, monthly 136
gage heights 135
Walker River basin:
description 131
gaging stations 131
stream flow 132-138
Walker River near—
Wabuska, Nev.:
description 134
discharge 134
discharge, daily 136
discharge, monthly 136
gage heights 135
Walker River (East Fork) near—
Yerington, Nev.:
description 132
discharge 132
discharge, monthly 134
gage heights 132-133
rating tables 133
Walker River (West Fork) near—
Coleville, Cal.:
description 136-137
discharge 137
discharge, monthly 138
gage heights 137-138
rating table 138
Wasatch Mountains drainage:
miscellaneous measurements 142
principal streams 28-29
stream flow 31-85
Water power, stream flow and 7
Water supply, stream flow and 7
Weber River basin:
description 52-53
gaging stations 53
stream flow 53-62
Weber River near—
Croydon, Utah:
description 56
discharge 56
discharge, monthly 58
gage heights 57
rating tables 58
Oakley, Utah:
description 53
discharge 54
discharge, monthly 55-56
gage heights 54-55
rating table 55

Weber River near—Continued. Page.
Plain City, Utah:
description 59
discharge 59
discharge, monthly 61–62
gage heights 59–60
rating tables 60–61
Weir method, description of 14–15
White House ranch, Oregon,
Willow Creek near:
discharge 143
Williams, A. D., work of 26
Willow Creek near—
White House ranch, Oregon:
discharge 143
Wood, B. D., work of 26
Woodford, Cal., Page.
Carson River (West Fork) near:
description 128
discharge 129
discharge, monthly 130
gage heights 129–130
rating table 130
Work, division of 26

Y.

Yerington, Nev.,
Walker River (East Fork) near:
description 132
discharge 132
discharge, monthly 134
gage heights 132–133
rating tables 133

O

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 251

SURFACE WATER SUPPLY OF THE UNITED STATES

1907–8

PART XI. CALIFORNIA

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. B. CLAPP AND W. F. MARTIN

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

CONTENTS.

	Page.
Introduction	9
Authority for investigations	9
Scope of investigations	10
Purposes of the work	11
Publications	12
Definition of terms	15
Convenient equivalents	16
Explanation of tables	17
Field methods of measuring stream flow	18
Office methods of computing and studying discharge and run-off	24
Accuracy and reliability of field data and comparative results	29
Use of the data	29
Cooperation and acknowledgments	30
Division of work	31
Lower Colorado River basin	31
Colorado River at Hardyville, Ariz	31
Colorado River at Yuma, Ariz	33
Salton Sea	38
Description	38
Salton Sea near Salton	43
Alamo and New rivers near Brawley, Cal	45
The Great Basin drainage	46
General features	46
Honey Lake basin	47
Mono Lake basin	47
Owens River basin	49
Description	49
Owens River near Round Valley, Cal	52
Owens River near Tinemaha, Cal	55
Rock Creek near Round Valley, Cal	59
Pine Creek near Round Valley, Cal	61
Bishop Creek near Bishop, Cal	64
Baker Creek near Big Pine, Cal	66
Big Pine Creek near Big Pine, Cal	67
Birch Creek near Tinemaha, Cal	70
Tinemaha Creek near Tinemaha, Cal	72
Taboose Creek near Tibbetts, Cal	74
Goodale Creek near Tibbetts, Cal	77
Division Creek near Independence, Cal	79
Sawmill Creek near Independence, Cal	81
Thibaut Creek near Independence, Cal	82
Oak Creek near Independence, Cal	82
Independence Creek near Independence, Cal	85
Shepard Creek near Thebe, Cal	87

The Great Basin drainage—Continued.
Owens River basin—Continued. Page.
Bairs Creek near Independence, Cal 88
George Creek near Thebe, Cal 89
Lone Pine Creek near Lone Pine, Cal 90
Tuttle Creek near Lone Pine, Cal 92
Cottonwood Creek near Olancha, Cal 94
Ash Creek near Olancha, Cal 97
Mohave River basin 99
Description 99
South Pacific Ocean drainage 100
General features 100
Tia Juana River drainage basin 101
Description 101
Cottonwood Creek near Jamul, Cal 102
Pine Valley Creek near Jamul, Cal 103
Sweetwater River drainage basin 105
Description 105
Sweetwater River near Descanso, Cal 106
San Diego River drainage basin 109
Description 109
San Diego River and San Diego flume near Lakeside, Cal 110
Bernardo River drainage basin 115
Description 115
Santa Ysabel Creek near Escondido, Cal 116
San Luis Rey River drainage basin 119
Description 119
San Luis Rey River near Pala, Cal 120
Santa Ana River drainage basin 123
Description 123
Santa Ana River and Mentone Power Company's canal near Mentone, Cal 124
Seepage measurements 129
San Gabriel River drainage basin 131
Description 131
San Gabriel River and power canal near Azusa, Cal 133
Los Angeles River drainage basin 138
Description 138
Diversions from Los Angeles River 138
Santa Ynez River drainage basin 139
Description 139
Santa Ynez River near Santa Barbara, Cal 140
Santa Ynez River near Lompoc, Cal 142
Salinas River drainage basin 145
Description 145
Arroyo Seco near Soledad, Cal 146
San Francisco Bay drainage 149
General features 149
Sacramento River basin 149
Description 149
Sacramento Valley 153
Main Sacramento River 154
Sacramento River near Red Bluff, Cal 154

San Francisco Bay drainage—Continued.
Sacramento River System—Continued. Page.
Pit River drainage basin 157
Description 157
Pit River near Bieber, Cal 159
McCloud River near Gregory, Cal 162
Cottonwood Creek drainage basin 165
Description 165
North Fork Cottonwood Creek at Ono, Cal 165
Stony Creek drainage basin 168
Description 168
Stony Creek near Fruto, Cal 169
Little Stony Creek near Lodoga, Cal 173
Cache Creek drainage basin 175
Description 175
Cache Creek at Lower Lake, Cal 177
Cache Creek near Yolo, Cal 179
Puta Creek drainage basin 183
Description 183
Puta Creek at Winters, Cal 184
Feather River drainage basin 187
Description 187
North Fork of Feather River above Prattville, Cal 190
North Fork of Feather River below Prattville, Cal 192
North Fork of Feather River near Big Bend, Cal 195
Feather River at Oroville, Cal 199
Hamilton Branch near Prattville, Cal 202
Butt Creek at Butte Valley, Cal 204
Indian Creek near Crescent Mills, Cal 208
Yuba River drainage basin 210
Description 210
Yuba River near Smartsville, Cal 212
Bear River drainage basin 216
Description 216
Bear River at Van Trent, Cal 217
American River drainage basin 220
Description 220
American River near Fairoaks, Cal 221
San Joaquin River basin 225
Description 225
Main San Joaquin River 229
San Joaquin River near Pollasky, Cal 229
San Joaquin River at Herndon, Cal 231
Tulare Lake Basin 233
Description 233
Tulare Lake in Kings County, Cal 233
Kern River drainage basin 237
Description 237
Kern River near Bakersfield, Cal 239
Tule River drainage basin 241
Description 241
Tule River near Portersville, Cal 243
Kaweah River drainage basin 245
Description 245
Kaweah River below Three Rivers, Cal 247

San Francisco Bay drainage—Continued.
San Joaquin River basin—Continued. Page.
Kings River drainage basin 250
Description 250
Kings River near Sanger, Cal 251
Merced River drainage basin 255
Description 255
Merced River in Yosemite Valley, Cal 256
Merced River above Merced Falls, Cal 259
Tenaya Creek in Yosemite Valley, Cal 262
Yosemite Creek in Yosemite Valley, Cal 265
Tuolumne River drainage basin 267
Description 267
Tuolumne River at Lagrange, Cal 269
Modesto Canal near Lagrange, Cal 274
Turlock Canal near Lagrange, Cal 277
Lagrange Water and Power Company's canal near Lagrange, Cal 279
Stanislaus River drainage basin 280
Description 280
Stanislaus River at Knights Ferry, Cal 282
Stanislaus Water Company's canal at Knights Ferry, Cal 285
Calaveras River drainage basin 288
Description 288
Calaveras River at Jenny Lind, Cal 289
Mokelumne River drainage basin 292
Description 292
Mokelumne River near Clements, Cal 294
Cosumnes River drainage basin 297
Description 297
Cosumnes River at Michigan Bar, Cal 298
North Pacific Ocean drainage 300
Klamath River drainage basin 300
Description 300
Upper Klamath Lake near Klamath Falls, Oreg 302
Link River at Klamath Falls, Oreg 303
Lower Klamath Lake near Brownell, Cal 309
Klamath River gages 310
Klamath River at Keno, Oreg 314
Williamson River near Klamath Agency, Oreg 316
Lost River near Clear Lake, Cal 318
Lost River at Olene, Oreg 321
Lost River near Merrill, Oreg 324
Tule Lake near Merrill, Oreg 327
Miller Creek near Lorella, Oreg 329
Evaporation station at Keno, Oreg 331
Miscellaneous measurements 332
The Great Basin in California 332
South Pacific Ocean drainage area 335
San Francisco Bay drainage area 336
Klamath River drainage basin 336
Fluctuations in ground-water levels in the valley of southern California, by W. C. Mendenhall 338
Index 349

ILLUSTRATIONS.

Page.

PLATE I. *A*, Current-meter rating station at Los Angeles, Cal.; *B*, Bridge station and cross section of stream, illustrating 0.2 and 0.8 depth method 20

II. Price penta-recording current meters 22

III. *A*, Salton Sea near Salton station, Southern Pacific Railroad, 205 feet below sea level, August 29, 1906; *B*, New River cutting back and undermining its banks, causing the destruction of many acres of fine farm land 42

IV. *A*, East Park dam site on Little Stony Creek; *B*, Stony Creek gaging station near Fruto 168

V. *A*, Power house of the Stanislaus Electric Power Company, Stanislaus River; *B*, Falls on Bubbs Creek, tributary to Kings River 250

VI. *A*, Lagrange dam from left bank of Tuolumne River at Lagrange; *B*, Concrete-lined canal and tunnel portal of main Klamath canal near Klamath Falls, Oreg 270

VII. Map of valley of southern California, showing location of wells selected to show ground-water conditions 338

FIGURE 1. Discharge, area, and mean velocity curves for Kaweah River below Three Rivers, Cal 25

SURFACE WATER SUPPLY OF CALIFORNIA, 1907–8.

By W. B. Clapp and W. F. Martin.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

> Provided that this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited to that which can be provided with the appropriations available. The field covered and the character of the work are believed to be the best that could be accomplished under the controlling conditions. It would undoubtedly be of more scientific importance and ultimately of more practical value if the money now applied to wide areas were concentrated on a few small basins. Such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be maintained during a period of years sufficient to cover all stages, in order that within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum may be determined. The length of such a period manifestly varies for different streams and can not be absolutely determined. Experience has shown that the records should cover from five to ten years, or for some streams twenty years or more, the limit being determined by the relative importance of the stream and the interdependence of the results and other long-time records on adjacent streams.

In the performance of this work the Geological Survey endeavors to approach as nearly as possible the highest degree of precision which a rational expenditure of time and a judicious expenditure of a small amount of money will allow. In all engineering work there is a point of refinement beyond which it is needless and wasteful to proceed, and this principle applies with especial force to stream-flow measurements. It is confidently believed that with some unavoidable exceptions the stream-flow data presented in the publications of the Survey are sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of many stations. All persons are cautioned to exercise the greatest care in the utilization of such incomplete records.

Records of varying lengths have been obtained at about 1,400 different points in the United States, and in addition the surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1907 and 1908 regular gaging stations were maintained by the Survey and cooperating organizations at about 740 points in the United States, and in addition numerous miscellaneous measurements were made. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country. These data will be made available in the regular surface water-supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

Among the purposes for which the results contained in this volume are requisite are navigation, irrigation, domestic water supply, water power, swamp, and overflow land drainage, and flood prevention. The demands of all these interests are immediate.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation, and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $42,000,000 on federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system is based absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are of first importance in the redemption of the lands, as well as constituting an insurance of federal and private investments.

Domestic water supply.—The highest use of water is that of domestic supply, and while the federal interest in this aspect of the matter is less direct than in the aspects already named this use of water nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The time is rapidly approaching when the development of the water power of the country will be an economic necessity. Our stock of coal is being rapidly depleted and the cost of steam power is increasing accordingly. Industry will cease its growth if cheap power is not available, and in that event the United States as a nation will cease to progress. Water power is the only avenue now open. When the electric transmission of power was accomplished, the relation of our water powers to national economy changed entirely. Previous to the day of electric transmission the importance of a water power was largely confined to the locality at which it was generated, but it has now become a public utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available is dependent on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worthless, or of precarious value, by reason of overflow and swamp conditions. When this land is drained it becomes exceedingly productive and its value increases many fold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the

first consideration in connection with drainage projects. If by the drainage of a large area into any particular channel that channel becomes so gorged with water which it had not hitherto been called upon to convey that overflow conditions are created in places where previously the land was not subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States exceeds $100,000,000 annually, and in the year 1908 the aggregate damage, based on reliable data, approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications has varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided in to twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1907 and 1908. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1907–8.

Part.	No.	Title.	Part.	No.	Title.
I	241	North Atlantic coast	VI	246	Missouri River Basin.
II	242	South Atlantic coast and eastern Gulf of Mexico.	VII	247	Lower Mississippi River Basin.
III	243	Ohio River Basin.	VIII	248	Western Gulf of Mexico.
IV	244	St. Lawrence River Basin.	IX	249	Colorado River Basin.
V	245	Upper Mississippi River and Hudson Bay basins.	X	250	Great Basin.
			XI	251	California.
			XII	252	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive, and dates also are inclusive, so far as the data are available.

Stream-flow data in reports of the United States Geological Survey.

[Ann. = Annual Report; B. = Bulletin; W. S. = Water-Supply Paper.]

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage heights, and ratings	1892 and 1894.
16th Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1896.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	do	1903.
W. S. 124 to 135	do	1904.
W. S. 165 to 178	do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1908. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1908.

	1899.[a]	1900.[b]	1901.	1902.	1903.	1904.	1905.	1906.	1907–8.
Atlantic coast and eastern Gulf of Mexico:									
New England rivers	35	47	65, 75	82	97	124	165	201	241
Hudson River to Delaware River, inclusive	35	47, (48)	65, 75	82	97	125	166	202	241
Susquehanna River to York River, inclusive	35	48	65, 75	82	97	126	167	203	241
James River to Yadkin River, inclusive	(35), 36	48	65, 75	(82), 83	(97), 98	126	167	203	242
Santee River to Pearl River, inclusive	36	48	65, 75	83	98	127	168	204	242
St. Lawrence River	36	49	65, 75	(82), 83	97	129	170	206	244
Hudson Bay	.....	.....	66, 75	85	100	130	171	207	245
Mississippi River:									
Ohio River	36	48, (49)	65, 75	83	98	128	169	205	243
Upper Mississippi River	36	49	65, 75	83	98, (99)	128, (130)	171	207	245
Missouri River	(36), 37	49, (50)	66, 75	84	99	130, (131)	172	208	246
Lower Mississippi River	37	50	(65), 66, 75	(83), 84	(98), 99	(128), 131	(169), 173	(205), 209	247
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248
Pacific coast and Great Basin:									
Colorado River	(37), 38	50	66, 75	85	100	133, (134)	175, (177)	211, (213)	249, (251)
Great Basin	38, (39)	51	66, 75	85	100	133, (134)	176, (177)	212, (213)	250, (251)
South Pacific coast to Klamath River, inclusive	(38), 39	51	66, 75	85	100	134	177	213	251
North Pacific coast	38	51	66, 75	85	100	135	(177), 178	214	252

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply paper 52.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	All stations in Colorado and Great Basin drainages lying in California repeated.
	Great Basin	

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the mouth of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated above, and in the records for large lakes, where it is often clearer to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.40 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.

1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.

$1\frac{1}{3}$ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ =net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, rating table, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage height and rating tables are omitted and a table of daily discharge is substituted. For stations where the flow is computed by shifting-channel methods a table of daily discharge is given in place of rating tables, which are not used in these methods of computation.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also full information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with siutable footnotes. The rating is not applicable for such periods unless the proper correction to

the gage heights is known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which the rating tables and monthly-discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is published to enable engineers to determine the daily discharge by its application to the table of gage heights or to check results in the table of monthly discharge.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the period when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 15, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir or dam; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $V=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions. It is seldom used by the United States Geo-

logical Survey. For full information regarding this method the reader is referred to the various text-books on hydraulics.

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of sharp-crested and broad-crested weirs within the limits for which accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, crest which is not level, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general, records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current-meter gaging stations under unobstructed-channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.

The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200 [a]) and in the various text-books on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The editions of both of these water-supply papers are practically exhausted. They can, however, be consulted at most of the larger libraries of the country or they can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 20 cents for No. 180 and 35 cents for No. 200. Remittances must be made by postal money order, express order, or New York draft.

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently but which do not cause a variation of more than about 5 per cent of the discharge curves from year to year; and (4) those with constantly shifting beds. In

[a] Water-Supply Paper 200 is a revision of No. 150, the edition of which is exhausted.

determining the daily flow different office methods are necessary for each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

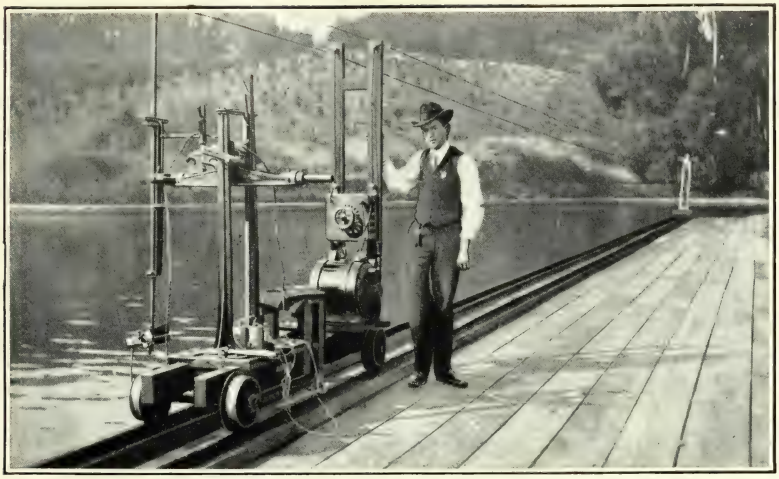
Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years unless funds are available to cover all changes in conditions of flow. A straight, smooth section, without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the expense of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 2 to 5 per cent or less of the total width, will within reasonable limits yield better results for a given outlay of money than semipermanent or shifting sections with smooth, uniform current. So far as possible, stations are located where the banks are high and not subject to overflow at high stages and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

In making a measurement with a current meter, a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *B*.) These points are spaced equally for those parts of the section where the flow is uniform and smooth, and are spaced unequally for other parts, according to the discretion and judgment of the engineer. In general, the points should not be spaced farther apart than 5 per cent of the distance between piers, nor farther apart than the approximate mean depth at the time of measurement.

The measuring points divide the total cross section into elementary strips, at each end of which observations of depth and velocity



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.

B. BRIDGE STATION AND CROSS SECTION OF STREAM.

Illustrating 0.2 and 0.8 depth method.

are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total discharge of the stream. (For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.)

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method, with its various modifications of surface, subsurface, and tube or rod floats, is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity. (For further information regarding this method the reader is referred to Water-Supply Paper 95 and to the various text-books covering the general subject of stream flow.)

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions. Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations. On the sides the same type of meter is shown equipped for wading measurements, to record by the acoustic method on the left and by the electric method on the right. Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened-steel point when immersed in moving water. The number of revolutions is indicated electrically. The rating or relation between the velocity

of the moving water and the revolutions of the wheel is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. (See Pl. I, *A*.) From these data a rating table is prepared which gives the velocity per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds, and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

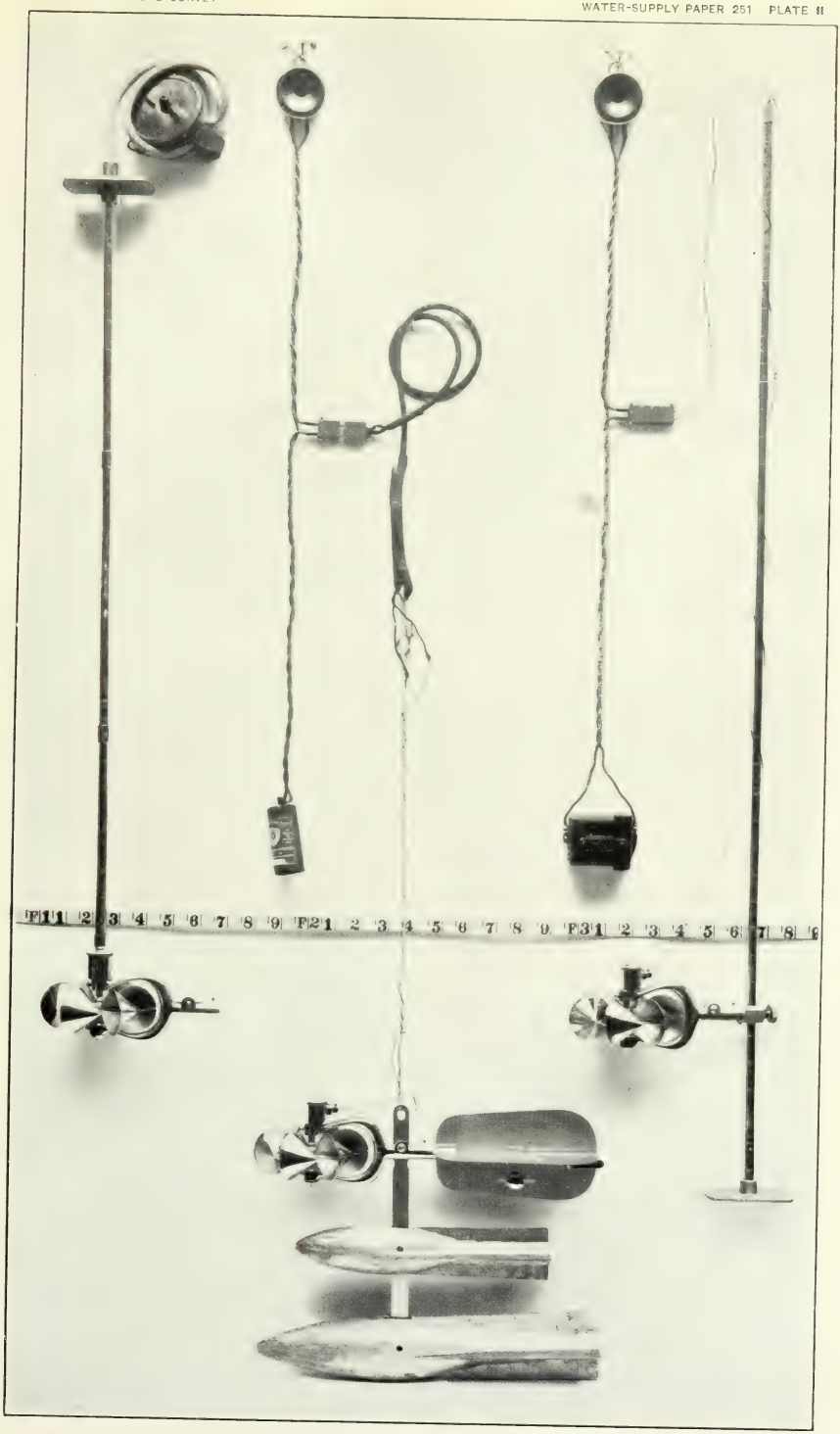
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I, *B*.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and



PRICE PENTA-RECORDING CURRENT METERS.

0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper 187.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 19.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are more or less generally parabolic in form. In many cases curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every published rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating as stated in the footnote of each table is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. (See fig. 1.) The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool, below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of

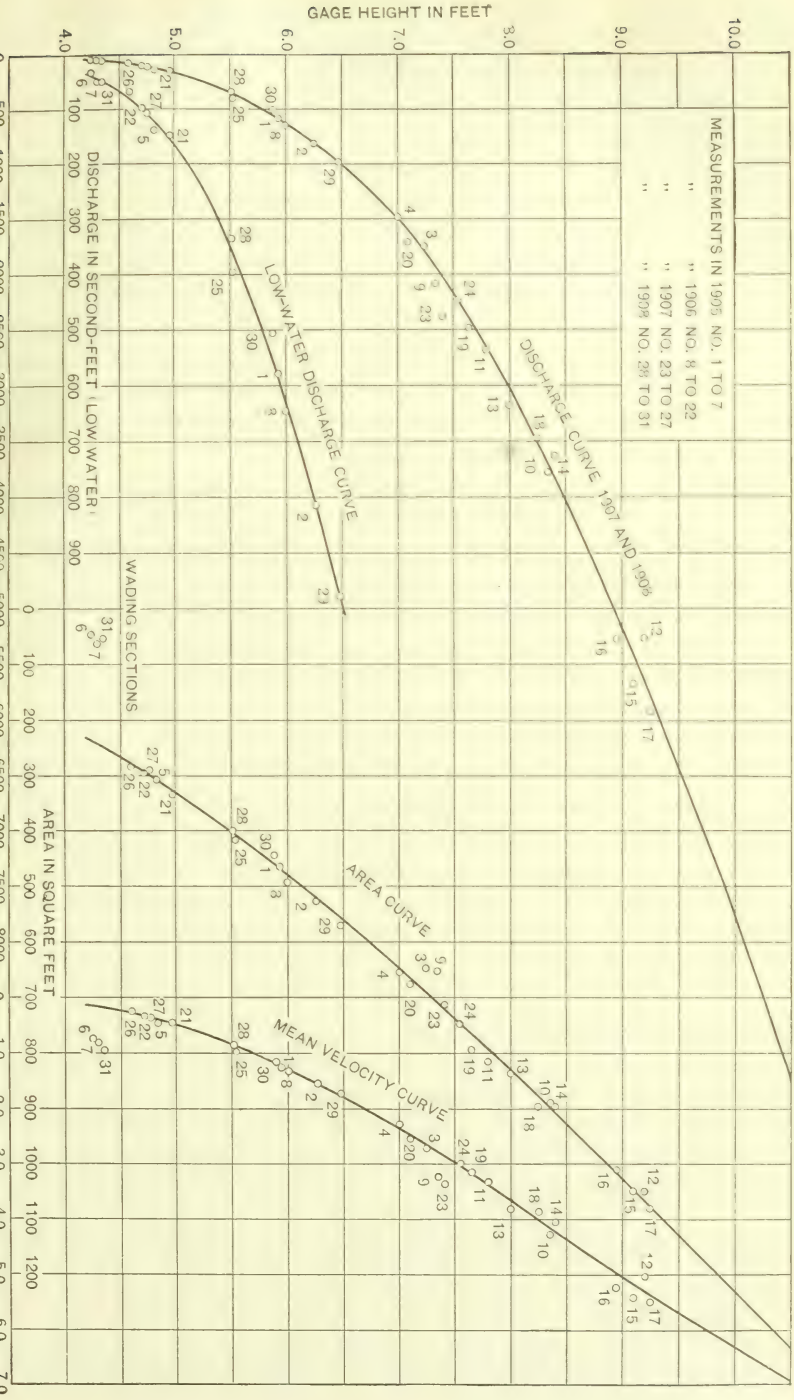


FIGURE 1.—Discharge, area, and mean-velocity curves for Kaweah River below Three Rivers, Cal.

the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean discharge curve and the rating developed from that curve represents a very high degree of accuracy.

Class 2 is confined mainly to stations on rough mountainous streams with steep slope. The beds of such streams are as a rule comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class, results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law. If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to their ordinates or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is, of course, fundamentally due to change in the channel caused by cut or fill, or both, at and near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either reduces or increases all three values of discharge, area, and velocity for any given gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky controlling point, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class. For illustrative example of a station of this type, see Water-Supply Paper 242.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to

the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. For illustrative example of a station of this type, showing the Bolster method of determining the daily discharge graphically, see Water-Supply Paper 249.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as is feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the monthly discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions wherever available, daily records of temperature and precipitation obtained from the United States Weather Bureau, climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates, they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all, and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are, as a rule, included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed, even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the rating tables and an accuracy column is inserted in the monthly discharge table. In the rating tables "well defined" indicates in general that the rating is probably accurate within 5 pe rcent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly-discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the Survey engineers. This is done to comply with the law, but also for the

express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for five or ten year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates. This is particularly true of the maximum and minimum figures, which in the very nature of the method of collecting these data are liable to large errors. The maximum value should be increased considerably for many stations in considering designs for spillways, and the minimum value should be considered for a group of, say, seven days and not for one day.

The rating table, provided the engineer accepts it, is published primarily to allow him to apply it directly to the daily gage heights and rearrange the daily discharges in order of magnitude or by some other method.

COOPERATION AND ACKNOWLEDGMENTS.

The hydrographic work of the United States Geological Survey in California is being carried on in cooperation with the State in accordance with acts of the state legislature, approved March 16, 1903, March 20, 1905, and March 11, 1907.

The act of March 16, 1903, which covered the period from July 1, 1903, to June 30, 1905, is in substance as follows:

> The state board of examiners are hereby empowered to enter into contracts with the Director of the United States Geological Survey for the purpose of making topographic maps to the extent of twenty thousand dollars; also for the purpose of gaging streams, surveying reservoir sites and canal locations, for the conservation and utilization of the flood and storm waters of the State, to the extent of fifteen thousand dollars * * *.

The acts of March 20, 1905, and March 11, 1907, are in substance the same as the previous acts, the appropriations being increased to $30,000 for topography and $20,000 for hydrography, and covering the four fiscal years July 1, 1905, to June 30, 1909.

Assistance has been rendered or records furnished by the following, to whom acknowledgment is due: Department of Engineering of the State of California, Nathaniel Ellery, state engineer; James N. Gillett, governor. Thanks are also due to Mr. D. W. Lewis, of Corcoran, Cal., for gage readings in Tulare Lake; to the Kern County Land Company, through A. K. Warren, engineer in charge of water measurements, for the record of Kern River; to the city of Santa Barbara for cooperation in gaging Santa Ynez River; to the Great Western Power Company, through Mr. M. A. Viele, chief engineer, for gage heights and stream measurements on Feather River and tributaries; to the Southern Pacific Company, through its chief engineer, William Hood, for river stage records of San Joaquin River at Herndon, Cal.; to the Los Angeles Aqueduct for cooperation in the Owens River drainage basin; and to the Southern California Mountain Water Company for cooperation on Cottonwood and Pine Valley creeks.

DIVISION OF WORK.

The field work in California, except in the Klamath River basin, was carried on under the direction of W. B. Clapp, assisted by W. F. Martin, W. V. Hardy, W. G. Steward, R. S. Hawley, W. A. Lamb, G. A. Shuey, R. B. Post, and A. T. Barrows. The ratings, computations, and special estimates were made by W. B. Clapp and W. F. Martin, assisted by W. A. Lamb and R. B. Post. The field work in the Klamath River basin was carried on under the direction of J. C. Stevens, assisted by C. E. Ellsworth, Howard Kimble, H. D. McGlashan, and L. F. Hendricks. The ratings and computations were made by F. F. Henshaw, G. C. Stevens, H. D. Padgett, and G. L. Parker. The manuscript was prepared for publication by F. F. Henshaw and R. C. Rice, and edited by Mrs. B. D. Wood.

LOWER COLORADO RIVER BASIN.[a]

COLORADO RIVER AT HARDYVILLE, ARIZ.

This station, which is located one-quarter mile above the deserted town of Hardyville and 7 miles above Fort Mohave, Ariz., was established May 11, 1905, and was discontinued October 1, 1907. It was maintained in cooperation with the State of California.

The bed of the stream is composed of cemented gravel and changes gradually as the river falls from flood stage to low water, a bar forming in that portion of the section nearest the right bank and altering conditions of flow materially. The right bank is composed of cemented gravel, is high and not subject to overflow; the left bank is made up of alluvial material, easily eroded, is low and wooded,

[a] For detailed description of Colorado River basin, see Water-Supply Paper 249.

and is liable to overflow at flood stages. Discharge measurements are made from a car and cable. The datum of the staff gage, which has remained the same since the establishment of the station, is at elevation 507.18 feet above sea level. The gage is located 275 feet below the cable from which discharge measurements are made.

Discharge measurements of Colorado River at Hardyville, Ariz., in 1907.

[By Cavin, Fackler, and Somers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 5	6.95	9,270	April 6	9.15	22,300	July 6	15.30	104,000
January 12	6.56	7,410	April 13	9.36	24,800	July 13	14.40	100,000
January 19	6.88	8,890	April 20	12.28	42,500	July 18	13.00	64,200
January 26	6.69	7,910	April 28	10.92	35,200	July 20	12.9	57,200
February 2	6.89	8,260	May 4	10.45	31,600	July 27	11.2	50,800
February 9	7.30	10,500	May 11	9.95	26,900	August 3	10.65	45,900
February 16	7.30	10,500	May 18	10.60	38,300	August 10	9.72	44,100
February 23	7.45	11,600	May 25	13.45	67,900	August 17	8.80	27,200
March 2	7.69	14,200	June 1	14.40	65,600	August 24	8.60	23,400
March 9	8.11	14,900	June 8	13.78	65,300	September 1	8.60	21,800
March 16	7.59	15,000	June 11	15.38	110,000	September 8	8.40	22,300
March 23	7.80	14,200	June 22	15.40	104,000	October 6	7.20	13,400
March 30	9.78	29,200	June 29	14.70	81,000			

Daily gage height, in feet, of Colorado River at Hardyville, Ariz., for 1907.

[Marion Derrick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.65	6.8	7.7	9.8	10.2	14.4	14.8	11.05	8.5
2	6.85	6.9	7.7	9.7	10.2	14.0	14.6	10.8	8.45
3	6.75	6.8	.....	9.5	10.2	13.2	15.0	10.65	8.9
4	6.9	6.8	7.8	9.5	10.45	.....	15.1	10.2	9.2
5	6.95	6.9	8.0	9.4	10.55	13.0	15.0	10.7	8.85
6	7.0	7.3	7.9	9.15	10.55	12.9	15.3	10.5	8.9
7	6.9	7.25	8.25	9.15	10.5	13.0	15.1	10.4	8.8
8	6.8	7.2	8.2	9.05	10.4	13.8	15.0	10.15	8.8
9	6.7	7.3	8.1	9.05	10.4	14.3	15.0	9.7	8.6
10	6.7	7.3	8.0	9.2	10.2	14.7	14.8	9.7	.....
11	6.6	7.3	8.3	9.3	10.0	15.35	14.7	9.45	8.1
12	6.55	.....	8.1	9.3	9.85	15.5	14.7	9.25	8.05
13	6.6	7.4	8.0	9.4	9.8	15.45	14.4	9.15	7.95
14	6.6	7.35	7.85	9.65	9.85	15.3	14.2	9.0	7.85
15	6.7	7.35	7.7	9.9	9.75	15.0	14.0	8.9	7.65
16	6.8	7.3	7.65	10.5	.....	15.1	13.7	8.9	7.55
17	6.9	7.3	7.55	11.25	10.15	15.3	13.35	8.8	7.4
18	.....	7.4	7.5	11.8	10.65	15.0	13.0	8.75	7.5
19	6.9	7.5	7.6	12.05	11.1	15.4	13.2	8.7	7.6
20	6.85	7.6	7.5	12.35	11.3	15.4	12.9	8.6	7.35
21	6.75	7.45	.....	12.5	11.3	15.2	12.65	8.4	7.15
22	6.7	7.4	7.5	12.35	11.5	15.4	11.9	.....	7.2
23	6.75	7.45	7.8	12.3	11.8	15.05	11.6	8.2	7.2
24	6.7	7.9	7.7	12.2	12.4	15.4	11.2	8.6	7.3
25	6.65	7.6	7.65	.....	13.6	14.8	10.9	.....	7.35
26	6.65	7.5	8.5	11.35	14.5	14.85	11.05	8.9	7.4
27	6.7	7.4	9.0	10.95	15.5	14.7	11.2	8.1	.....
28	6.65	7.9	9.6	10.75	15.0	14.7	10.9	8.0	7.35
29	6.65	.....	9.5	10.5	14.9	14.7	11.15	7.9	7.1
30	6.5	.....	9.6	10.3	14.4	14.7	11.1	8.5	7.05
31	6.65	.....	9.8	.....	.....	.....	11.1	8.75	.....

Daily discharge, in second-feet, of Colorado River at Hardyville, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,800	7,900	14,100	28,600	29,400	65,600	86,200	50,000	21,400
2	8,800	8,260	14,200	27,500	29,400	61,000	83,600	47,300	21,200
3	8,300	7,850	14,300	25,700	29,500	52,300	93,200	45,900	24,800
4	9,100	7,850	14,400	25,400	31,600	52,100	96,000	42,500	25,800
5	9,270	8,300	15,400	24,400	32,400	52,000	95,500	48,600	25,200
6	9,600	10,500	14,400	22,300	32,400	52,000	104,000	47,700	25,600
7	9,000	10,200	16,400	22,500	31,800	54,000	102,000	47,600	25,000
8	8,550	9,990	15,800	21,900	30,900	65,700	102,000	46,400	25,000
9	8,000	10,500	14,900	22,000	30,700	77,300	104,000	43,000	23,600
10	8,000	10,500	14,600	23,300	29,000	89,500	102,000	44,100	22,000
11	7,500	10,500	17,100	24,100	27,400	110,000	102,000	40,000	20,000
12	7,410	10,800	16,200	24,300	26,900	112,000	105,000	36,600	19,600
13	7,600	11,000	16,100	25,200	27,400	110,000	100,000	34,200	19,000
14	7,600	10,800	15,600	25,800	28,600	106,000	93,400	31,800	18,200
15	8,000	10,800	15,200	26,800	28,600	98,500	87,500	30,000	16,900
16	8,500	10,500	15,400	30,700	31,800	100,000	80,000	29,000	16,200
17	9,000	10,600	14,400	36,000	33,600	104,000	71,500	27,200	15,300
18	8,950	11,100	13,800	40,000	38,700	96,700	64,200	25,600	16,000
19	8,900	11,700	14,200	41,800	42,800	106,000	64,000	26,000	16,400
20	8,700	12,200	13,200	43,000	44,400	105,000	57,200	24,800	14,800
21	8,200	11,400	13,000	45,600	44,000	100,000	56,300	23,000	13,600
22	7,900	11,300	12,600	44,900	45,600	104,000	49,500	22,900	13,900
23	8,200	11,600	14,200	45,000	48,700	95,000	47,700	21,700	13,800
24	7,900	14,400	13,800	44,600	55,000	102,000	45,300	23,400	14,400
25	7,700	12,900	13,500	41,500	70,200	87,500	44,000	24,600	14,600
26	7,700	12,400	19,000	37,800	83,500	87,500	47,800	25,200	14,900
27	7,850	12,000	22,700	35,100	102,000	83,800	50,800	19,200	14,900
28	7,500	15,100	27,400	33,800	87,300	82,200	47,600	18,400	14,700
29	7,400	.....	26,800	31,900	82,000	81,000	50,800	17,500	13,000
30	6,700	.....	27,800	30,200	70,400	82,600	50,300	21,600	12,700
31	7,300	.....	29,000	.....	67,500	.....	50,400	20,600	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Colorado River at Hardyville, Ariz., for 1907.

Month.	Discharge, in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	9,600	6,700	8,160	592,000	B.
February	15,100	7,850	10,800	600,000	B.
March	29,060	12,600	16,800	1,030,000	B.
April	45,600	21,900	31,700	1,890,000	B.
May	102,000	26,900	44,900	2,760,000	B.
June	112,000	52,000	85,900	5,110,000	B.
July	104,000	44,000	75,300	4,630,000	B.
August	50,000	17,500	32,500	2,000,000	B.
September	25,800	12,700	18,400	1,090,000	B.
The period	.....	.....	.....	19,600,000	

COLORADO RIVER AT YUMA, ARIZ.

This station, which is located in the town of Yuma, Ariz., 1½ miles below the mouth of Gila River, and 10 miles by river above the Mexican border, furnishes information concerning the amount of water available for irrigation along lower Colorado River. Records of river height have been kept by the Southern Pacific Railroad Company since April 1, 1878.

The records given herewith are furnished by the United States Reclamation Service, through F. L. Sellew, project engineer, Yuma, Ariz.

As the bed of the stream is composed of silt and sand and is very unstable, frequent measurements are necessary to properly define the daily discharge. The right bank is low, wooded, and liable to overflow; the left bank is not subject to overflow. Previous to May 31, 1903, discharge measurements were made from the railroad bridge. On that date a cable station was established at a point 600 feet below the bridge, and all measurements are now made from a car, except during highest floods, when a boat is used. At flood stages a large part of the water flows through an old channel and does not pass under the cable. At such times this overflow water is measured at the point where it passes under the railway trestle, one-third mile north of the main channel.

During the flood of May and June, 1905, there were two breaks in the railroad grade at Araz, Cal., 4 miles from Yuma, and the water passing through these is included in each discharge measurement of the Colorado.

The staff gage is in two sections, the upper section, reading above 24 feet, being the original gage established in 1876. It is located at the railroad bridge, 600 feet above the cable section. The elevation of the zero of the gage is 137.4 feet above sea level.

Discharge measurements of Colorado River at Yuma, Ariz., in 1907 and 1908.

[By Robertson, North, Dyer, and Priest.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 1	22.75	36,600	March 15	21.2	19,700	May 29	27.0	61,800
January 3	20.85	24,700	March 18	20.8	16,900	June 1	28.4	72,400
January 5	20.6	18,800	March 20	20.4	14,800	June 3	29.1	77,000
January 7	20.2	15,200	March 25	22.0	26,200	June 6	28.95	87,100
January 9	20.0	15,900	March 27	21.5	20,200	June 8	27.75	80,100
January 11	20.7	18,200	March 30	23.0	31,200	June 10	26.9	72,200
January 14	22.0	29,700	April 1	22.8	29,000	June 12	27.1	81,800
January 16	20.5	20,400	April 3	23.2	32,100	June 15	28.05	94,400
January 18	19.8	16,300	April 6	22.7	29,200	June 17	28.55	101,000
January 21	21.7	27,300	April 8	22.4	27,400	June 19	29.15	106,000
January 23	20.6	22,100	April 10	22.2	24,700	June 22	29.05	108,000
January 25	20.15	15,900	April 13	22.45	25,900	June 24	28.9	112,000
January 28	19.7	13,200	April 15	22.5	26,000	June 26	28.9	114,000
January 30	19.6	12,700	April 17	23.0	29,500	June 29	28.6	115,000
February 2	22.05	29,500	April 20	24.8	41,500	July 1	28.3	113,000
February 4	21.6	27,100	April 22	25.55	46,900	July 6	27.4	107,000
February 6	20.6	18,800	April 24	25.8	49,900	July 8	27.5	108,000
February 8	20.4	17,900	April 27	25.6	45,700	July 10	27.8	110,000
February 11	20.9	20,300	April 29	24.7	44,600	July 15	27.8	114,000
February 13	20.6	17,400	May 1	23.75	35,500	July 17	27.5	110,000
February 16	20.5	16,600	May 4	23.2	32,400	July 20	26.75	102,000
February 18	20.4	14,900	May 6	23.1	33,000	July 22	25.65	92,000
February 20	20.2	14,100	May 8	23.3	33,900	July 24	24.8	82,400
February 23	21.0	17,400	May 11	23.2	32,800	July 29	23.1	58,600
February 25	20.7	15,000	May 13	22.8	30,400	July 31	22.8	55,400
February 28	21.9	22,900	May 15	22.65	29,100	August 3	23.3	61,900
March 2	20.75	16,700	May 18	22.8	28,600	August 5	22.85	55,300
March 5	21.0	18,000	May 20	23.5	31,900	August 7	22.45	50,600
March 9	24.65	46,200	May 22	24.4	37,500	August 10	22.15	49,900
March 11	22.2	26,500	May 25	24.7	41,300	August 12	21.45	41,300
March 13	21.75	24,900	May 27	25.55	51,000	August 14	20.95	33,900

Discharge measurements of Colorado River at Yuma, Ariz., in 1907 and 1908—Cont'd.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
August 17	20.45	32,900	January 20	18.1	5,600	August 5	20.7	21,400
August 19	20.25	28,600	January 27	18.4	6,300	August 7	21.1	25,200
August 22	20.25	26,800	January 30	18.4	6,100	August 10	22.05	31,900
August 24	19.95	24,500	February 5	18.7	7,400	August 12	21.8	28,200
August 26	20.5	27,300	February 7	23.95	45,000	August 14	21.05	24,000
August 29	20.3	25,000	February 11	19.7	14,200	August 17	20.6	20,700
August 31	19.6	23,100	February 14	20.0	14,900	August 19	20.4	20,500
September 2	22.25	43,300	February 19	19.7	12,900	August 21	20.45	19,300
September 4	21.25	35,000	February 21	19.9	10,600	August 24	22.4	33,800
September 7	21.25	34,500	February 24	19.7	9,900	August 26	22.1	28,200
September 9	20.75	31,900	February 26	20.65	16,900	August 28	21.6	25,000
September 11	20.5	27,600	March 3	20.25	11,700	August 31	20.65	18,900
September 14	19.65	21,900	March 9	22.2	27,000	September 2	20.4	19,200
September 16	19.2	18,400	March 11	21.1	18,700	September 4	20.1	16,600
September 21	19.0	15,500	March 12	21.9	24,700	September 7	19.6	14,100
September 23	19.0	14,100	March 14	20.6	15,200	September 11	19.3	11,800
September 25	19.0	13,400	March 17	20.05	13,100	September 17	19.1	10,400
September 28	19.1	13,400	March 19	19.85	11,300	September 19	18.8	8,900
October 1	18.9	12,000	March 23	20.2	13,200	September 21	18.7	8,200
October 3	18.8	11,300	March 25	20.15	14,300	September 23	18.65	7,700
October 5	18.7	10,300	March 28	20.95	17,200	September 25	18.6	7,000
October 8	18.75	10,300	March 31	20.8	16,100	September 28	18.8	7,500
October 10	19.1	12,200	April 2	20.8	16,100	September 30	18.8	7,200
October 12	19.7	15,900	April 6	20.4	13,900	October 3	18.9	6,600
October 14	19.75	15,500	April 9	20.2	13,100	October 5	19.4	8,200
October 17	19.6	14,000	April 17	20.6	13,600	October 7	19.5	8,500
October 19	19.5	13,800	April 22	21.1	16,500	October 9	19.8	10,000
October 21	19.55	14,600	April 25	22.0	27,100	October 12	19.5	8,600
October 23	19.95	15,900	April 27	21.95	26,000	October 14	19.8	9,900
October 26	19.5	14,200	April 29	22.05	28,100	October 19	19.3	7,700
October 28	20.25	18,800	May 2	22.7	29,800	October 23	19.4	8,200
October 30	19.9	16,300	May 5	22.0	27,100	October 26	21.15	20,600
November 2	19.55	14,300	May 9	21.4	23,100	October 28	20.05	13,700
November 4	19.4	12,900	May 13	21.65	25,100	October 30	19.75	12,100
November 6	19.3	11,900	May 16	21.55	23,500	November 2	19.3	9,900
November 9	19.1	11,800	May 18	22.2	27,900	November 4	19.2	9,200
November 12	19.1	10,900	May 22	22.3	27,500	November 6	19.3	8,500
November 14	19.1	10,700	May 26	22.15	25,500	November 9	19.3	8,200
November 18	18.8	9,600	May 31	22.8	31,300	November 11	19.4	8,200
November 20	18.8	9,900	June 5	22.6	30,900	November 13	19.5	8,700
November 23	18.8	9,600	June 8	22.4	33,600	November 16	19.5	8,000
November 26	18.7	9,100	June 12	23.3	35,200	November 18	19.6	7,600
November 29	18.7	9,000	June 15	23.2	38,700	November 20	19.6	7,500
December 2	18.5	8,600	June 17	23.3	39,400	November 23	19.55	7,300
December 5	18.3	7,800	June 19	24.35	48,300	November 25	19.7	7,200
December 7	18.3	8,000	June 22	24.95	55,100	November 27	19.7	7,400
December 9	18.3	7,500	June 24	25.25	59,700	November 30	19.2	6,000
December 12	18.3	7,900	June 26	25.35	61,700	December 2	19.2	6,200
December 14	18.5	7,700	June 29	24.6	55,400	December 4	19.4	6,600
December 16	18.45	7,300	July 1	24.5	53,800	December 7	19.6	7,400
December 18	18.4	7,300	July 4	24.2	53,100	December 9	19.6	7,700
December 21	18.4	7,400	July 6	23.8	49,300	December 11	19.55	7,400
December 24	18.35	7,500	July 8	23.05	41,100	December 12	19.5	7,300
December 28	18.15	6,300	July 10	22.3	35,400	December 14	19.4	6,900
December 30	18.1	6,000	July 13	21.9	31,200	December 16	19.1	6,100
			July 15	21.5	29,800	December 17	19.4	7,300
1908.			July 17	21.2	28,800	December 19	27.1	72,500
January 2	18.0	5,800	July 20	21.0	25,600	December 20	27.3	68,900
January 5	18.2	6,400	July 22	20.7	24,600	December 22	21.5	25,400
January 8	18.6	7,400	July 24	20.7	24,100	December 23	23.1	37,200
January 11	18.4	6,900	July 27	20.55	21,600	December 26	20.6	19,400
January 13	18.3	6,700	July 29	20.1	19,300	December 28	19.8	11,800
January 16	18.2	5,900	July 31	20.2	18,900	December 30	19.2	11,200
January 18	18.1	5,600	August 3	20.85	22,700			

Daily gage height, in feet, of Colorado River at Yuma, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	22.95	19.55	20.85	22.85	23.75	28.45	28.3	23.1	20.65	18.9	19.9	18.6
2	21.2	21.55	20.8	22.9	23.45	28.9	28.05	23.1	22.25	18.9	19.55	18.5
3	20.9	22.4	21.25	23.2	23.3	29.1	27.65	23.3	21.6	18.8	19.4	18.5
4	20.7	21.5	21.0	23.05	23.2	29.2	27.4	23.05	21.2	18.65	19.4	18.4
5	20.6	21.1	21.1	22.8	23.1	29.15	27.4	22.85	21.55	18.7	19.35	18.3
6	20.3	20.65	21.25	22.75	23.15	28.9	27.35	22.5	21.5	18.7	19.3	18.3
7	20.2	20.35	22.85	22.65	23.25	28.3	27.35	22.45	21.25	18.75	19.2	18.3
8	19.9	20.6	27.0	22.35	23.3	27.7	27.5	22.45	20.65	18.75	19.2	18.3
9	20.0	20.95	24.55	22.2	23.3	27.25	27.7	22.3	20.75	19.0	19.1	18.3
10	20.7	21.0	23.2	22.2	23.2	26.85	27.8	22.15	21.0	19.1	19.15	18.3
11	20.7	20.9	22.3	22.4	23.15	26.95	28.05	21.85	20.5	19.1	19.1	18.3
12	23.7	20.75	21.7	22.5	23.0	27.15	28.0	21.45	20.0	19.7	19.1	18.3
13	23.3	20.6	21.85	22.45	22.85	27.45	28.05	21.25	19.65	19.7	19.1	18.4
14	22.0	20.5	21.8	22.5	22.65	27.75	27.95	20.95	19.65	19.75	19.1	18.5
15	21.1	20.55	21.35	22.5	22.65	28.05	27.8	20.65	19.35	19.4	19.0	18.4
16	20.5	20.5	21.15	22.8	22.75	28.25	27.65	20.5	19.2	19.4	18.9	18.45
17	19.95	20.4	20.9	23.05	22.7	28.55	27.5	20.45	19.15	19.6	18.8	18.45
18	19.8	20.4	20.7	23.5	22.8	28.85	27.45	20.3	19.05	19.65	18.8	18.4
19	21.4	20.35	20.55	24.25	23.0	29.1	27.1	20.25	18.95	19.5	18.8	18.35
20	22.85	20.2	20.4	24.8	23.6	29.15	26.75	20.1	18.9	19.35	18.8	18.4
21	21.5	20.55	20.4	25.15	24.1	29.15	26.1	20.3	19.0	19.55	18.85	18.4
22	21.0	21.25	20.4	25.5	24.45	29.1	25.65	20.25	19.25	19.2	18.8	18.5
23	20.6	20.95	20.4	25.75	24.6	29.0	25.3	20.1	19.0	19.95	18.8	18.5
24	20.3	20.75	20.55	25.85	24.7	28.9	24.85	19.95	19.0	19.9	18.8	18.35
25	20.1	20.7	22.3	25.85	24.75	28.9	24.3	20.2	19.0	19.8	18.7	18.3
26	20.0	21.4	22.3	25.75	25.05	28.85	23.6	20.5	19.0	19.5	18.7	18.3
27	19.8	21.85	21.5	25.6	25.5	28.75	23.25	20.4	19.05	19.4	18.6	18.3
28	19.7	21.3	21.7	25.3	26.15	28.7	23.0	20.5	19.1	20.25	18.65	18.15
29	19.6	.....	22.95	24.8	26.95	28.6	23.1	20.3	19.25	19.7	18.7	18.1
30	19.6	.....	23.0	24.3	27.5	28.4	22.8	19.9	19.05	19.9	18.6	18.1
31	19.6	.....	23.05	.....	27.95	.....	22.8	19.6	.....	20.25	.....	18.0
1908.												
1	18.0	18.5	20.3	20.75	22.7	22.85	24.5	20.35	20.4	18.8	19.4	19.2
2	18.0	18.5	20.25	20.8	22.7	22.75	24.45	20.8	20.4	18.8	19.3	19.2
3	18.1	18.6	20.25	20.7	22.55	22.6	24.25	20.95	20.3	19.0	19.2	19.4
4	18.2	18.7	20.85	20.5	22.3	22.6	24.1	20.6	20.05	19.3	19.2	19.4
5	18.4	18.75	21.0	20.4	22.0	22.6	23.9	20.75	19.8	19.6	19.25	19.55
6	18.45	19.7	20.7	20.4	21.75	22.3	23.75	21.1	19.65	19.7	19.25	19.6
7	18.55	23.8	20.65	20.25	21.55	22.3	23.35	21.2	19.55	19.55	19.3	19.6
8	18.6	21.4	23.05	20.1	21.4	22.5	23.05	21.55	19.5	19.75	19.3	19.6
9	18.6	20.35	22.2	20.2	21.35	22.7	22.7	22.25	20.05	19.8	19.3	19.6
10	18.55	19.75	21.4	20.05	21.4	22.95	22.3	22.0	19.5	19.6	19.4	19.6
11	18.4	19.7	21.45	20.1	21.55	23.2	22.1	21.8	19.25	19.5	19.4	19.5
12	18.3	19.7	21.9	20.25	21.7	23.3	22.0	21.7	19.2	19.5	19.5	19.5
13	18.3	19.95	21.0	20.45	21.65	23.5	21.85	21.0	19.4	19.65	19.5	19.5
14	18.3	20.0	20.6	20.6	21.6	23.5	21.7	21.15	19.1	19.7	19.5	19.3
15	18.2	19.95	20.55	20.65	21.45	23.3	21.4	20.65	19.05	19.45	19.5	19.2
16	18.2	19.9	20.3	20.7	21.55	23.2	21.3	20.5	19.9	19.35	19.55	19.1
17	18.1	19.8	20.05	20.6	21.95	23.3	21.2	20.6	19.25	19.25	19.6	19.3
18	18.1	19.7	19.9	20.65	22.2	23.8	21.05	20.35	18.9	19.25	19.6	19.65
19	18.1	19.7	19.85	20.7	22.25	24.3	21.0	20.4	18.8	19.3	19.6	26.25
20	18.1	19.8	19.8	20.8	22.3	24.6	21.0	20.2	18.75	19.3	19.6	26.25
21	18.1	19.9	19.8	20.8	22.3	24.75	20.9	20.45	18.7	19.3	19.6	21.5
22	18.1	20.05	20.1	21.1	22.3	25.0	20.7	20.8	18.75	19.3	19.6	21.3
23	18.1	19.75	20.2	21.7	22.2	25.2	20.55	21.3	18.65	19.35	19.6	23.05
24	18.2	19.7	20.35	21.95	22.0	25.2	20.7	22.45	18.6	19.4	19.75	22.1
25	18.2	19.95	20.45	22.0	22.0	25.25	20.7	22.35	18.6	20.05	19.7	21.15
26	18.35	20.65	20.75	21.95	22.15	25.3	20.7	22.05	18.6	21.05	19.7	20.5
27	18.4	20.8	20.9	21.95	22.5	25.15	20.5	21.8	18.65	20.5	19.7	20.1
28	18.45	20.7	20.95	22.0	22.9	24.8	20.2	21.45	18.8	20.05	19.6	19.75
29	18.5	20.4	20.9	22.05	23.0	24.55	20.1	20.85	18.8	19.75	19.45	19.45
30	18.5	.....	20.85	22.45	22.9	24.55	20.2	20.9	18.85	19.7	19.2	19.15
31	18.4	.....	20.8	.....	22.75	.....	20.25	20.6	.....	19.6	.....	18.85

Daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	38,400	12,400	17,200	29,300	35,500	72,900	113,000	57,500	31,100	12,000	16,300	8,800
2	26,900	25,700	16,900	29,900	32,600	76,200	111,000	58,500	43,300	11,600	14,300	8,600
3	25,000	31,300	19,300	32,100	31,200	77,000	110,000	61,900	38,400	11,300	12,900	8,500
4	21,600	26,600	18,000	30,700	32,400	77,700	110,000	58,200	35,000	10,300	12,900	8,100
5	18,800	24,400	18,500	28,500	31,800	77,400	110,000	55,300	38,000	10,300	12,500	7,800
6	16,000	19,200	19,300	29,200	33,000	87,100	107,000	51,200	37,600	10,100	11,900	7,900
7	15,200	17,700	28,600	28,900	33,700	83,300	107,000	50,600	34,300	10,200	11,800	8,000
8	16,100	19,000	68,700	27,100	33,900	80,100	108,000	50,600	35,200	10,300	11,800	7,800
9	15,900	20,500	45,100	24,700	33,900	77,200	110,000	50,300	31,900	11,500	11,800	7,500
10	18,400	20,800	34,500	24,700	33,500	72,200	110,000	49,900	33,300	12,200	11,600	7,600
11	18,200	20,300	27,300	27,400	32,800	72,700	112,000	46,200	27,600	12,200	11,200	7,700
12	44,300	18,900	24,700	28,000	30,600	81,800	112,000	41,300	24,200	15,900	10,900	7,900
13	40,900	17,400	25,800	25,900	30,400	86,500	114,000	38,300	21,900	15,600	10,800	7,800
14	29,700	16,600	25,400	26,000	29,500	90,400	113,000	33,900	21,900	15,500	10,700	7,700
15	24,400	17,000	21,100	26,000	29,100	94,400	114,000	29,500	19,600	13,500	10,500	7,500
16	20,400	16,600	19,200	28,100	30,000	97,100	114,000	32,200	18,400	13,500	10,200	7,300
17	17,100	14,900	17,600	29,500	29,600	101,000	110,000	32,900	17,700	14,000	10,000	7,300
18	16,300	14,900	16,200	33,000	28,600	105,000	109,000	29,700	16,300	14,000	9,600	7,300
19	25,200	14,700	15,600	38,200	29,600	106,000	104,000	28,600	14,900	13,800	9,800	7,300
20	33,400	14,100	14,800	41,500	31,900	106,000	102,000	25,400	14,200	13,600	9,900	7,300
21	25,800	15,500	14,800	43,800	34,700	106,000	94,900	29,200	15,500	14,600	9,700	7,400
22	23,900	18,400	14,800	46,900	37,500	108,000	92,000	26,800	16,500	13,200	9,600	7,500
23	22,100	17,200	14,800	48,300	38,700	110,000	88,900	25,700	14,100	15,900	9,600	7,500
24	18,000	15,400	15,900	49,900	39,300	112,000	82,400	24,500	13,800	15,900	9,400	7,500
25	15,200	15,000	28,400	50,500	41,300	113,000	76,800	25,800	13,400	15,500	9,300	7,200
26	15,000	19,600	28,400	49,300	45,700	114,000	68,800	27,300	13,100	14,200	9,100	7,100
27	13,800	22,600	20,200	45,700	51,000	115,000	62,700	26,300	13,200	13,800	8,800	6,900
28	13,200	19,000	21,700	46,200	57,800	115,000	58,800	27,300	13,400	18,800	8,900	6,300
29	12,700	.....	30,800	44,600	61,800	115,000	58,600	25,000	14,000	15,500	9,000	6,100
30	12,700	.....	31,200	43,500	65,500	115,000	52,400	23,900	13,200	16,300	8,800	6,000
31	12,700	.....	31,600	.....	68,800	.....	55,400	23,100	.....	17,800	.....	5,800
1908.												
1	5,800	6,300	13,400	15,900	32,000	32,200	53,800	18,600	17,300	7,200	10,200	6,000
2	6,100	6,300	12,500	16,400	30,000	31,300	53,000	22,400	19,200	7,200	9,900	6,200
3	6,100	6,500	11,700	15,800	29,500	30,300	49,800	22,700	19,300	6,600	9,400	6,700
4	6,400	6,900	16,000	14,600	28,500	30,600	53,100	21,800	16,600	7,900	9,200	6,600
5	7,000	7,400	16,500	14,300	27,100	30,900	52,400	21,400	14,000	8,200	9,600	7,000
6	7,200	9,500	14,000	13,900	25,400	30,000	49,300	24,900	12,700	9,200	8,500	7,400
7	7,300	45,000	13,400	13,500	24,100	31,200	45,000	25,200	14,100	8,500	8,500	7,400
8	7,400	30,000	33,000	13,100	23,200	33,500	41,100	29,500	13,600	9,200	8,500	7,400
9	7,400	19,000	27,000	13,400	23,100	33,900	37,300	36,100	16,400	10,000	8,200	7,700
10	7,200	15,000	20,900	12,900	23,300	34,300	35,400	31,900	13,600	9,000	8,200	7,700
11	6,900	14,200	18,700	13,000	24,500	34,800	33,900	30,100	11,800	8,500	8,200	7,400
12	6,800	14,200	24,700	13,200	25,200	35,200	33,100	28,200	11,000	8,600	8,700	7,300
13	6,700	14,800	18,500	13,400	25,100	36,000	31,200	23,700	12,600	9,300	8,700	7,300
14	6,700	14,900	15,200	14,000	25,000	35,600	29,100	24,000	10,300	9,900	8,700	6,900
15	6,400	14,800	15,000	14,100	23,000	38,700	29,800	21,800	9,900	8,400	8,700	6,100
16	5,900	14,600	14,300	14,000	23,500	40,200	29,100	20,900	16,400	8,000	8,000	6,100
17	5,800	14,300	13,400	13,600	26,000	39,400	28,800	20,700	10,400	7,500	7,600	7,300
18	5,600	12,900	12,500	13,800	27,900	43,600	28,300	18,900	9,000	7,500	7,600	8,300
19	5,600	12,900	11,300	14,000	28,000	48,300	28,100	20,500	8,900	7,700	7,600	72,500
20	5,600	11,800	10,500	14,700	28,100	50,400	25,600	20,300	8,600	7,700	7,500	68,900
21	5,600	10,600	10,100	14,800	27,800	51,700	24,000	19,300	8,200	7,700	7,500	25,400
22	5,600	11,500	13,400	16,500	27,500	55,100	24,600	22,600	8,600	7,700	7,500	25,400
23	5,600	10,000	13,200	24,000	27,000	57,900	24,100	25,600	7,700	8,200	7,300	37,200
24	5,800	9,900	14,000	27,100	26,000	59,700	24,100	33,800	7,200	8,200	7,200	29,800
25	5,800	11,700	14,300	27,100	25,000	59,700	24,100	33,400	7,000	11,400	7,200	22,900
26	6,100	16,900	16,000	26,200	25,500	61,700	24,100	28,200	7,000	20,600	7,200	19,400
27	6,300	17,400	17,000	26,000	29,900	58,700	21,600	22,600	7,700	16,000	7,400	15,800
28	6,400	17,000	17,200	27,000	32,800	50,700	19,800	25,000	7,500	13,700	7,300	14,800
29	6,400	16,000	17,000	28,100	33,700	55,400	19,300	20,200	7,500	11,800	6,700	12,800
30	6,300	.....	16,800	35,000	32,800	55,000	19,800	20,500	7,200	12,100	6,000	11,200
31	6,100	.....	16,100	.....	31,300	.....	18,900	18,900	.....	11,300	.....	9,100

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Colorado River at Yuma, Ariz., for 1907 and 1908.

[Drainage area, 225,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	44,300	12,700	21,500	0.096	0.11	1,320,000	B.
February	31,300	12,400	18,800	.084	.09	1,040,000	B.
March	68,700	14,800	24,100	.107	.12	1,480,000	B.
April	50,500	24,700	35,300	.157	.18	2,100,000	B.
May	68,800	28,600	37,900	.168	.19	2,330,000	B.
June	115,000	72,200	94,800	.421	.47	5,640,000	B.
July	114,000	52,400	96,400	.428	.49	5,930,000	B.
August	61,900	23,100	37,600	.167	.19	2,310,000	B.
September	43,300	13,100	23,200	.103	.12	1,380,000	B.
October	18,800	10,100	13,600	.060	.07	836,000	B.
November	16,300	8,800	10,800	.048	.05	643,000	B.
December	8,800	5,800	7,450	.033	.04	458,000	B.
The year	115,000	5,800	35,100	.156	2.12	25,500,000	
1908.							
January	7,400	5,600	6,320	.028	.03	389,000	B.
February	45,000	6,300	14,200	.063	.07	817,000	B.
March	33,000	10,100	16,100	.072	.08	990,000	B.
April	35,000	12,900	17,800	.079	.09	1,060,000	B.
May	33,700	23,000	27,200	.121	.14	1,670,000	B.
June	61,700	30,000	42,900	.191	.21	2,550,000	B.
July	53,800	18,900	32,600	.145	.17	2,000,000	B.
August	36,100	18,600	24,300	.108	.12	1,490,000	B.
September	19,300	7,000	11,400	.051	.06	678,000	B.
October	20,600	6,600	9,510	.042	.05	585,000	B.
November	10,200	6,000	8,090	.036	.04	481,000	B.
December	72,500	6,000	15,900	.071	.08	978,000	B.
The year	72,500	5,600	18,900	.084	1.14	13,700,000	

SALTON SEA.

DESCRIPTION.

Salton Sink originally formed a part of the Colorado Desert, which has an area of nearly 2,000 square miles, extends in a northwesterly direction almost 100 miles from the California-Mexico boundary line, and comprises two fertile valleys, one to the northwest of the sink, in Riverside County, known as the Coachella Valley, and the other to the southeast of the sink, in Imperial County, called the Imperial Valley. Salton Sea, which now partly fills the sink, lies between the two valleys and is partly in Riverside County and partly in Imperial County. The longest diameter of the sea has a northwest-southeast direction. On December 31, 1908, its surface was 206 feet below mean sea level, and it had a length of nearly 45 miles, a maximum width of about 15 miles, a minimum width of 9.5 miles, a maximum depth of 67.5 feet, and a superficial area of about 443 square miles. It is about 160 miles southeast of Los Angeles, 90 miles northwest of Yuma, and 50 miles north of Calexico.

A few thousand years ago, according to geologic evidence, what is now Salton Sea was a part of the Gulf of California, which then

extended about 200 miles farther northwest than at present. It is probable that the gulf waters then swept inland to the base, or nearly to the base, of San Jacinto Peak, although all evidence which would enable us to fix its exact limits has been obliterated by still more recent geologic events. At that time the mouth of Colorado River was in the vicinity of Yuma, 60 miles in an air line north of its present location. Presumably, then, as now, it was discharging annually enough silt to cover 1 square mile to a depth of 53 feet with dry earth, equivalent to 1 cubic mile each century, cut from the great canyons in the upper Colorado and the Gila Valley and carried to the gulf. Running water will carry in suspension matter that quickly settles in still water, the settling process in this case being aided by the clarifying effect of the salt water.

As a result of these processes the Colorado delta was gradually extended southwestward toward the Cocopa Mountains, and when it reached them it had separated the old gulf into the present gulf and an inland sea. Delta growth, however, did not cease with the separation of the water body into two parts. Silt continued to be brought down the stream and to be deposited in its bed, along its banks, and in the still waters at its mouth. A stream, by this process of deposition along its channel, eventually builds the channel up until it is higher than the lands adjacent on either side. It is then in a condition of unstable equilibrium, and at some favorable time, as during an exceptional flood, it will break out of its immediate banks and establish itself in some more favorable course. By this process, oft repeated, it comes eventually to flow over all parts of its delta, building up each part in succession. By such a process the Colorado must have discharged alternately into the gulf and into the depression now known as the Salton Sink, meanwhile building up the delta dam that separates them until it reached a height of about 40 feet above sea level. During this process it is highly probable that water filled the Salton depression and evaporated from it many times, for it must have quickly disappeared whenever the erratic river changed its course to the gulf, for the run-off from the mountains that surround the sink is too slight to maintain a permanent water body in this region of intense evaporation. Meanwhile the original body of salt water that occupied the sink had been displaced by the volumes of fresh water poured into it from the river, and in the intermediate stages of the lake's existence, at least, its water was fresh or nearly fresh. A clear and definite indication of the last occupancy of this depression by a lake, presumably just before the river had shifted its course that it now follows to the gulf, may be seen in the remarkably well-preserved old water line that rims the desert from Indio to the Cerro Prieto at a height of 40 feet above sea level. On the rocky points that projected into

the lake it is marked by a thick deposit of calcium carbonate, by slightly cut sea cliffs, and by a change in the profile of the rocky spurs at the water line. Where alluvial cones and the sandy floor of the desert formed the shore line beaches have been developed, and although of soft sand and easily eroded, they are even now well preserved, thus testifying to the recency of the action that produced them. Over the floor of the desert and along the sandy beaches are myriads of shells of fresh or brackish water mollusks[a] that lived in the lake.

There are some reasons for thinking that the lake at this latest stage was not prefectly fresh, that its waters were at least distinctly "hard." Its area when it stood at 40 feet above sea level was somewhat in excess of 2,100 square miles. The average flow of the Colorado has been determined as about 11,000,000 acre-feet per annum. The evaporation from a surface of the area of the old lake, under the conditions that prevail here, has never been determined, but is undoubtedly high. If it is as high as 8 feet per annum, it would nearly equal the average annual inflow from the Colorado; if it is but 7 feet per annum, the average inflow would exceed the evaporation by 2,000 second-feet, or somewhat less than 14 per cent of the inflow. In either event, the waters of the lake would be markedly more alkaline after a term of years than those of the Colorado. The calcium carbonate incrustations on the rocky points about the shores of the old lake are best explained by supposing that the lake waters contained large quantities of this salt, so that wherever they broke in spray and evaporated more rapidly than usual the carbonate was deposited. This necessary excess of inflow over outflow at the period of maximum area of the lake, taken in connection with the thick calcium carbonate incrustations on the shores, indicates distinctly hard water. It may be assumed that other salts than calcium carbonate were also present in large amount, for the conditions that would lead to the abundance of one salt would also lead to an abundance of the others. The shells so thickly distributed over the desert floor, however, are not salt-water forms, but are identical with those now found living in the springs and occasional permanent streams about the desert borders. Many of these springs and streams are somewhat brackish, and the creatures flourish in them. It seems probable, then, that the lake waters also were rather alkaline, perhaps even brackish, at the time the lake attained its maximum area.

The period at which this lake disappeared can not be precisely fixed. The time units of geology are too large and too indefinite to translate satisfactorily into years, so that when we say that the disappearance of the lake is the most recent of geologic events we still

[a] Stearns, Robt. E. C., Remarks on fossil shells from the Colorado Desert: Am. Naturalist, vol. 13, pp. 141–154.

leave the mind groping for a definite human standard of time. The sandy beaches which mark the borders of the ancient lake are cut away, to be sure, where washes cross them from the mountains, but in sheltered places they are still perfect. Where they stretch across an embayment from one rocky point to another they are mere embankments of sand, old barrier beaches, with depressions behind them once occupied by shallow lagoons. In other areas, where they contour the alluvial cones, they are gullied and cut away where streams have flowed across them, but in other places are preserved unscarred. At one locality noted a low sea cliff that had been cut in alluvial-fan material was still preserved, although the loose sand and bowlders would slump in a few heavy storms.

In a region of abundant rainfall such ephemeral forms as these would be more nearly obliterated within fifty years after the lake had disappeared than they are now in the desert. In such a region the precipitation is twenty times that of the desert. It is the crudest of estimates—merely a guess, in fact—to state that, reasoning from geologic evidence alone, it may be a thousand years since the lake disappeared, yet it puts in concrete form such a guess as the geologist is able to make, and this guess may be correct within a margin of error of 50 per cent.

When human records are studied, some evidence on this point is found, but it is almost as uncertain as to time as that furnished by the physical features. The Indians in the Coachella Valley have distinct legends to the effect that at some time in the past the valley was occupied by a large body of water. Professor Blake records that they told him of a time when a great body of water existed in which were many fish, and of the manner in which that water disappeared "poco á poco"—little by little—until the lake became dry.

The Indians now living in the desert put this event as far back as the lives of four or five very old men, say four or five centuries ago at the most. There are, of course, no records and there is no known check on this assertion. Statements by Indians as to time, beyond the limits spanned by their own memories, are notoriously inaccurate. Furthermore, we do not know the means used to procure this statement. The native races are usually very prone to follow the suggestions contained in leading questions, and so to give the answer desired by the questioner. To obtain an entirely independent and unguided answer is one of the most delicate of tasks. Yet their statement has some value, and combining the evidence of the physical conditions and the Indian legends it may be said that it is probable that the lake disappeared and left the desert, as we have known it in historical time, from five hundred to one thousand years ago.

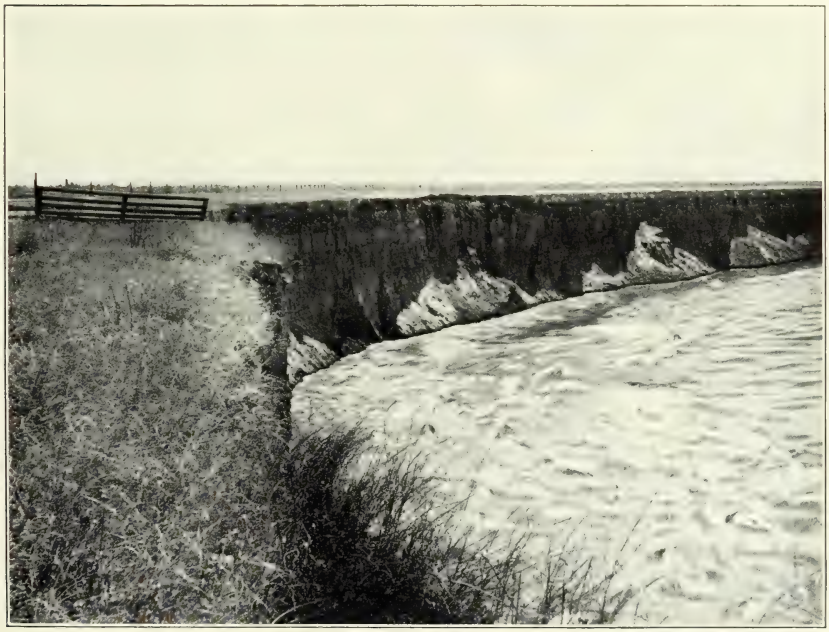
During the summer of 1891 the high water in the Colorado overflowed into Salton Sink to such an extent as to endanger the Southern

Pacific Railroad line at its lowest point. In the summer of 1905, after a succession of winter and spring floods in Gila River, followed by an exceptionally heavy summer flow in the Colorado, there was a repetition of flood conditions in the sink on a much larger scale.

The gravity of the situation on this latter date, however, was greatly augmented by the interference of man. For several years preceding a small quantity of water had been diverted from the Colorado below Yuma, Ariz., to be used by the settlers of the Imperial Valley for irrigation and domestic purposes. The first water was diverted in the United States and conveyed to the Imperial Valley, after passing through Mexican territory, by means of an old river channel which had been one of the Colorado's distributaries during the formation of its delta, and is now known as Alamo River. The increased demand for water and the silting up of the original canal heading above the boundary line necessitated the cutting of an additional channel from the river below the boundary to connect with the canal. It likewise silted up, and to supply the urgent need for water a canal was cut 4 miles below the original heading to connect Colorado and Alamo rivers. This canal was not provided with protective headworks and had a gradient much greater than that of the river, so that with the unusual and prolonged summer flood in 1905, it began cutting, until in July it was carrying 87 per cent of the total flow of the river. This large quantity of water flooded several hundred square miles about Calexico in the southern part of the Imperial Valley and caused serious loss both in the United States and in Mexico. These waters ultimately reached the Salton Sea, but in so doing they deepened and widened Alamo River into a great gorge and developed another drainage channel to the west through Imperial Valley in a second gorge now called New River (Pl. III, *A*). Notwithstanding all attempts to control it the Colorado continued to pour its waters through Alamo and New rivers into Salton Sea until the early fall of 1906, when it was finally shut off by the Southern Pacific Company. It broke again, however, on December 7, but was closed about two months later.

The rise of Salton Sea began in November, 1904, and continued throughout 1905 and 1906 and until February, 1907. In the summer of 1905 it endangered the Southern Pacific tracks to such an extent as to require frequent shifting to higher ground by means of "shoo-fly" or spur tracks, which served temporarily until the latter part of the year when a high line about 40 miles in length was completed on the 200-foot contour below sea level. This line is still in use, though during the latter part of 1906 and the early part of 1907, the lower portion of it was seriously damaged by the action of waves. For use in the future, if required, another line has been located and graded

A. SALTON SEA NEAR SALTON STATION, SOUTHERN PACIFIC RAILROAD, 205 FEET BELOW SEA LEVEL. AUGUST 29, 1906.



B. NEW RIVER CUTTING BACK AND UNDERMINING ITS BANKS, CAUSING DESTRUCTION OF MANY ACRES OF FINE FARM LANDS.

on the 150-foot contour below sea level. In addition to the damage done to the railroad the sea has completely submerged the plant of the New Liverpool Salt Company, below Mecca, and also a few ranches in the vicinity of Mecca.

SALTON SEA NEAR SALTON.

A record of gage heights was kept on Salton Sea from November, 1904, to February 26, 1906, by the New Liverpool Salt Company. Their datum is the lowest portion of the sink, or at least that portion which first filled with water, so that the gage record shows the actual depth of the water from time to time.

On February 23, 1906, the Government put in a gage on the same datum about one-half mile west of Salton railway station, which is 3 miles southeast of the old Salton station (Pl. III, *B*). This gage consisted of a series of five posts, 6 inches by 6 inches by 6 feet, set in the ground about 3 feet deep, and so placed that when the water covered one it would just reach the next one farther back. It was not a great while, however, until the waves completely destroyed this gage. In the meantime the Southern Pacific Company had graduated a bent on the trestle bridge across Salt Creek, about 2½ miles east of Salton, using the company's datum, and arrangements were made to have the Southern Pacific agent at Salton furnish the record from this gage, corrections being made to reduce the original datum. The zero of the gage is 273.5 feet below mean sea level as determined from United States Geological Survey bench marks, or at an elevation of −280.3 according to the Southern Pacific Company.

There is some uncertainty as to the elevation of the lowest point of Salton Sink, and it is now believed that the depth below sea level has been overestimated in the past. From the record of the depth of the water as it filled the lowest portion of the basin, as kept by the New Liverpool Salt Company, it appears that the maximum depth of water was 17 feet on October 4, 1905 (according to the gage and as checked by soundings later), when on the same date the water surface just covered the United States Geological Survey bench mark a few feet from the old Salton railway station. As this bench mark is 256.5 feet below mean sea level, it would appear that the lowest point of the sink is 273.5 feet below mean sea level instead of 287 feet, which has been accepted heretofore. In 1891 Southern Pacific engineers reported the lowest point in the sink as −280.2, which corresponds to −273.4, United States Geological Survey.

There was a large inflow to the sea during July and parts of June and August, 1907. The approximate inflow to the sea as determined by the discharge measurements made during the first half of 1908 is as follows:

	Second-feet.
January	500
February	400
March	200
April	200
May	200
June	125

Total inflow January 1 to June 30, 1908, 97,700 acre-feet, or sufficient to cover the surface of the sea about 0.34 foot deep.

Daily gage height, in feet, of Salton Sea near Salton, Cal., for 1907 and 1908.

[J. A. Jeffrey, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	72.6	75.4	76.0	75.9	.....	75.1	74.7	74.5	74.2	73.5	73.1	72.6
2	72.7	75.5	76.0	75.9	.....	75.1	74.7	74.5	74.2	73.4	73.1	72.6
3	72.8	75.6	76.0	75.9	.....	75.1	74.6	74.5	74.2	73.4	73.1	72.6
4	72.9	75.6	76.0	75.9	.....	75.1	74.6	74.5	74.2	73.4	73.0	72.5
5	72.9	75.7	76.0	75.9	.....	75.1	74.6	74.5	74.1	73.3	73.0	72.5
6	73.0	75.7	76.0	75.9	.....	75.1	74.6	74.5	74.1	73.3	73.0	72.5
7	73.0	75.8	76.0	75.9	.....	75.1	74.6	74.5	74.0	73.2	73.0	72.5
8	73.1	.....	76.0	75.9	.....	75.1	74.6	74.4	73.9	73.2	73.0	72.5
9	73.1	.....	76.0	75.9	.....	75.1	74.6	74.4	73.9	73.2	73.0	72.5
10	73.2	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.2	73.0	72.5
11	73.4	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.2	73.0	72.5
12	73.5	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.5
13	73.6	76.0	76.0	75.8	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.4
14	73.7	76.0	76.0	75.7	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.4
15	73.8	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.8	73.1	72.9	72.4
16	73.9	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.7	73.1	72.9	72.4
17	74.0	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.7	73.1	72.9	72.4
18	74.1	76.0	76.0	.....	75.3	74.9	74.6	74.4	73.7	73.1	72.8	72.4
19	74.2	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.1	72.8	72.4
20	74.3	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.8	72.4
21	.....	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.8	72.4
22	.....	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.7	72.4
23	.....	76.0	76.0	.....	75.1	74.9	74.6	74.3	73.6	73.2	72.7	72.4
24	.....	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.6	73.2	72.7	72.4
25	74.9	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.5	73.2	72.7	72.4
26	75.0	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.5	73.2	72.7	72.4
27	75.2	76.0	76.0	.....	75.1	74.7	74.6	74.3	73.5	73.2	72.6	72.3
28	75.3	76.0	76.0	.....	75.1	74.7	74.5	74.2	73.5	73.2	72.6	72.3
29	75.3	.....	76.0	.....	75.1	74.7	74.5	74.2	73.5	73.2	72.6	72.3
30	75.3	.....	75.9	75.6	75.1	74.7	74.5	74.2	73.5	73.1	72.6	72.3
31	75.3	.....	75.9	.....	75.1	.....	74.5	74.2	.....	73.1	.....	72.3
1908.												
1	72.3	72.3	72.2	71.9	71.6	71.0	70.5	70.1	69.4	68.6	67.9	67.6
2	72.3	72.3	72.2	71.9	71.6	71.0	70.5	70.1	69.3	68.6	67.9	67.6
3	72.3	72.3	72.2	71.9	71.5	70.9	70.5	70.0	69.3	68.5	67.9	67.6
4	72.3	72.3	72.2	71.9	71.5	70.9	70.5	70.0	69.3	68.5	67.9	67.6
5	72.3	72.3	72.1	71.9	71.5	70.9	70.4	70.0	69.3	68.5	67.9	67.6
6	72.3	72.3	72.1	71.9	71.5	70.9	70.4	70.0	69.3	68.5	67.9	67.6
7	72.3	72.4	72.1	71.9	71.4	70.9	70.4	69.9	69.3	68.5	67.9	67.6
8	72.3	72.4	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.9	67.6
9	72.3	72.4	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.8	67.5
10	72.3	72.3	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.8	67.5
11	72.3	72.3	72.1	71.8	71.4	70.8	70.3	69.9	69.2	68.4	67.9	67.5
12	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.2	68.4	67.9	67.5
13	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.4	67.8	67.5
14	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.4	67.8	67.5
15	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.3	67.8	67.5

Daily gage height, in feet, of Salton Sea near Salton, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	72.3	72.3	72.1	71.8	71.3	70.7	70.3	69.7	69.1	68.3	67.8	67.5
17	72.3	72.3	72.1	71.7	71.2	70.7	70.3	69.7	69.1	68.3	67.8	67.5
18	72.3	72.3	72.1	71.7	71.2	70.7	70.3	69.7	69.0	68.2	67.8	67.4
19	72.3	72.2	72.1	71.7	71.2	70.7	70.2	69.6	69.0	68.2	67.8	67.4
20	72.3	72.2	72.1	71.7	71.2	70.7	70.2	69.6	69.0	68.1	67.8	67.4
21	72.3	72.2	72.1	71.7	71.2	70.6	70.2	69.6	69.0	68.1	67.8	67.4
22	72.3	72.2	72.0	71.7	71.2	70.6	70.2	69.6	68.9	68.1	67.8	67.4
23	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.6	68.9	68.1	67.8	67.4
24	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.6	68.9	68.0	67.7	67.4
25	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.5	68.8	68.0	67.7	67.4
26	72.3	72.2	72.0	71.6	71.1	70.6	70.1	69.5	68.8	68.0	67.7	67.4
27	72.3	72.2	72.0	71.6	71.1	70.5	70.1	69.5	68.7	68.0	67.6	67.4
28	72.3	72.2	72.0	71.6	71.1	70.5	70.1	69.5	68.7	68.0	67.6	67.4
29	72.3	.....	72.0	71.6	71.1	70.5	70.1	69.4	68.7	67.9	67.6	67.4
30	72.3	.....	72.0	71.6	71.1	70.5	70.1	69.4	68.6	67.9	67.6	67.4
31	72.3	.....	72.0	.....	71.0	.....	70.0	69.4	.....	67.9	.....	67.4

Monthly rise of Salton Sea near Salton, Cal., for 1904–1908.

Month.	Monthly rise.	Total rise.	Month.	Monthly rise.	Total rise.	Month.	Monthly rise.	Total rise.
1904.	*Feet.*	*Feet.*	1906.	*Feet.*	*Feet.*	1907.	*Feet.*	*Feet.*
November	0.6	.....	March	2.7	28.3	September	−0.7	73.5
December	.2	0.8	April	5.6	33.9	October	− .4	73.1
1905.			May	8.6	42.5	November	− .5	72.6
January	1.4	2.2	June	15.4	57.9	December	− .3	72.3
February	1.6	3.8	July	8.6	66.5	1908.		
March	.8	4.6	August	2.9	69.4	January	.0	72.3
April	1.2	5.8	September	.9	70.3	February	− .1	72.2
May	1.0	6.8	October	1.2	71.5	March	− .2	72.0
June	2.2	9.0	November	− .2	71.3	April	− .4	71.6
July	4.4	13.4	December	1.2	72.5	May	− .6	71.0
August	2.2	15.6	1907.			June	− .5	70.5
September	1.2	16.8	January	2.8	75.3	July	− .5	70.0
October	1.4	18.2	February	.7	76.0	August	− .6	69.4
November	1.6	19.8	March	− .1	75.9	September	− .8	68.6
December	2.9	22.7	April	− .3	75.6	October	− .7	67.9
1906.			May	− .5	75.1	November	− .3	67.6
January	1.1	23.8	June	− .4	74.7	December	− .2	67.4
February	1.8	25.6	July	− .2	74.5			
			August	− .3	74.2			

ALAMO AND NEW RIVERS NEAR BRAWLEY, CAL.

Practically all the water that enters Salton Sea discharges through Alamo and New rivers, chiefly through the former. These rivers run through Imperial Valley and are the drainage channels for all the excess and waste water from the irrigation system and from the power plants.

During 1908 the following measurements were made on Alamo and New rivers, by H. R. Edwards, engineer for the New Liverpool Salt Company.

Discharge measurements of Alamo River near Brawley, Cal., in 1908.

[By H. R. Edwards.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
January 7	6.6	632	March 9	5.9	300	April 28	5.0	115
January 8	6.5	519	March 11	5.3	152	April 30	5.5	188
January 10	6.4	573	March 13	5.0	100	May 2	5.6	181
January 13	6.6	542	March 14	5.3	190	May 4	5.4	174
January 15	6.2	416	March 16	5.2	141	May 6	5.8	214
January 17	6.2	379	March 18	4.8	88	May 8	5.8	242
January 20	6.2	374	March 22	5.5	105	May 10	5.1	102
January 23	6.2	383	March 23	5.1	117	June 21	6.0	394
January 26	6.4	428	March 24	5.6	186	June 22	5.5	254
January 27	6.6	438	March 25	5.8	253	June 23	5.3	168
January 29	6.6	496	March 27	5.5	198	June 24	5.5	220
January 31	6.5	411	March 29	5.7	254	June 26	6.2	417
February 2	6.5	395	March 31	5.0	93	June 27	5.9	331
February 4	7.3	697	April 5	5.8	258	June 28	5.9	307
February 6	6.8	585	April 7	5.0	96	June 29	5.7	268
February 10	5.9	270	April 9	4.4	52	June 30	5.5	222
February 12	6.1	357	April 11	4.6	65	July 1	5.7	274
February 14	5.4	142	April 13	4.9	90	July 2	5.2	163
February 23	4.2	39	April 15	5.0	107	July 3	5.2	155
February 25	6.0	312	April 17	5.2	122	July 4	6.4	520
February 27	5.8	256	April 19	5.9	275	July 6	6.7	589
February 29	5.9	309	April 20	6.1	355	July 7	6.1	401
March 2	6.0	412	April 22	6.1	377	July 8	5.6	228
March 4	6.1	337	April 24	6.4	432			
March 6	5.9	266	April 26	5.1	142			

Discharge measurements of New River near Brawley, Cal., in 1908.

[By H. R. Edwards.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
February 23		44	April 13		40
March 23		36	June 22		26
April 5		39			

THE GREAT BASIN DRAINAGE.

GENERAL FEATURES.

The Great Basin drainage in California consists of all drainage from the eastern slope of the Sierra Nevada. It comprises all or a part of the drainage basins of Susan River and Honey Lake, Truckee River and Lake Tahoe, Carson River, Walker River, Mono Lake, and Owens River and Lake. Having no outlet to the ocean, the entire run-off from these basins is dissipated mainly through evaporation from the lakes and sinks in which the waters collect.

Investigations of flow have been made on the following streams in the Great Basin drainage in California: Susan River, Truckee River, Carson River, Walker River, tributaries of Mono Lake, Owens River and tributaries of Owens Lake, Mohave River.

Of these streams, the Truckee, Carson, and Walker discharge their waters outside of California, and are therefore not considered in this report.[a]

[a] See Water-Supply Paper 250.

HONEY LAKE BASIN.[a]

Honey Lake occupies a shallow depression in Honey Lake valley, in the southeastern part of Lassen County, Cal. It may be classed as a playa lake, as it is without outlet and becomes completely desiccated during seasons of unusual aridity. It is supplied principally by Susan River, which enters it from the northwest, but it receives also some tribute during the rainy season from Long Valley. The hot springs along its northern border also furnish considerable quantities of water. The area of the lake varies with the seasons as well as from year to year, as is common with all inclosed lakes. Its outline is indefinite, as its shores are usually low and marshy and in places form broad tule swamps. Its waters are quite strongly alkaline, unfit for human use, and are always of a greenish-yellow color, due to the impalpable mud held in suspension.

The following stations have been maintained in Susan River basin:

Susan River near Susanville, Cal. (1900 to 1905).
Willow Creek at Merrillville, Cal. (1904 to 1905).
Willow Creek near Standish, Cal. (1900 to 1905).

MONO LAKE BASIN.[b]

Lake Mono is situated in east-central California, within a few miles of the California-Nevada boundary. The thirty-eighth parallel and the one hundred and nineteenth meridian intersect in the center of the lake. It lies at the eastern base of the Sierra Nevada, and its drainage area forms one of the many independent hydrographic basins into which the vast region included between the Rocky Mountains and the Sierra Nevada, known as the Great Basin, is divided. The western rim of its drainage area, formed by the crest line of the Sierra Nevada, coincides for 36 miles with the western margin of the Great Basin.

Situated at the junction of two well-defined and strongly contrasted geographic provinces, the Mono basin partakes of leading characteristics of each. It is remarkable for its diversity of topography, its varied and striking contrasts of scenery, its wide range of climate, and corresponding variations of flora.

Lake Mono is 6,380 feet above the sea. The lowest pass in the serrate mountain crest along its western border is 3,000 feet above its surface. The highest peaks that overshadow it rise more than 6,000 feet above the level of the lake. The eastern portion of the basin partakes of the character of the arid region of interior drainage of which it forms a part, and includes valleys covered with sagebrush and rugged mountain slopes, which are but scantily clothed with

[a] Russell, I. C., Geological history of Lake Lahontan: Mon. U. S. Geol. Survey, vol. 11, 1885, pp. 55–56.
[b] Russell, I. C., Quaternary history of Mono Valley, Cal.: Eighth Ann. Rept. U. S. Geol. Survey, pt. 1, 1889, pp. 269–270, 287–288.

cedar and piñon. The tone of the landscape in this portion of the basin is gray and russet-brown, characteristic of the desert. Over its entire area no running water can be found during the greater part of the year, and the region is consequently silent and lifeless. To one reared under more humid skies this portion of the Mono basin would appear a veritable desert, but that it is not really a desert is shown by the fact that it produces nutritious bunch grass among the clumps of sagebrush in sufficient abundance to afford pasturage for a few cattle and horses.

The southwestern border of the basin includes magnificent mountains, that are clothed in favored places with forests of pine. The highest peaks reach far above the timber line and bear a varied and beautiful alpine flora. In the canyons that descend from the snow fields and miniature glaciers about the higher summits the rush of creeks and rills is heard throughout the year. The eastern and western portions of this single hydrographic basin are fragments of two distinct geographic provinces. One has the desolation and solitude of the Sahara, the other the rugged grandeur of the Pyrenees.

The lake derives the principal portion of its water supply from the creeks that descend the eastern slope of the Sierra and empty into it from the south and west. Supplementing the surface drainage are a number of springs, some of which are of considerable size.

The creeks tributary to Lake Mono are of clear, pellucid water, and flow through channels excavated for the most part in granite and metamorphosed sediments, but near their mouths they have eroded small gorges through lacustral marls and volcanic lapilli deposited during previous high-water stages of the lake. No chemical analyses of these waters have been made, but they have, without question, the normal purity of mountain streams. We may be sure, however, that like other streams they hold a small percentage of mineral matter in solution, which is left when evaporation takes place.

None of the springs of the basin are highly charged with mineral matter, but, on the contrary, some of the more copious are remarkable for their purity.

With the exception of a very small spring on the road between the town of Aurora and the valley of the same name, all springs of the basin are either in the bottom of the lake or quite near its shores, and they occur in greatest abundance near the base of the mountains. Only three of those that rise on the land have a temperature noticeably above the normal. The character of most of those rising in the bottom of the lake is uncertain. In some instances they reveal their presence in cold weather by the vapor to be seen on the lake surface above them, and are thus known to be thermal.

No gaging stations have been maintained on streams tributary to Mono Lake, but a few miscellaneous measurements were made in 1907. (See p. 332.)

OWENS RIVER BASIN.

DESCRIPTION.

Owens River basin is situated in the eastern part of California in Mono and Inyo counties, east of the main crest of the Sierra, which for a distance of about 140 miles forms the watershed between it and the basin of San Joaquin, Kings, and Kern rivers. It is south of Mono Lake basin and north of the arid region separating it from the Mohave Desert at the south. Its eastern limit is determined by the White Mountains at the north and the Inyo Mountains at the south. The length of the basin is about 120 miles; its width is about 20 miles at the south and 30 miles at the north, and its total area, including Owens Lake, comprises approximately 2,800 square miles, of which about 1,100 square miles are east of the river.

Owens River rises among the high peaks of the Sierra, east of Mount Lyell and directly opposite the headwaters of San Joaquin River, at an altitude of nearly 12,000 feet above sea level. It flows eastward into Long Valley, thence southwestward through Owens River canyon into Owens Valley, thence eastward and southward through the trough of the valley to Owens Lake, about 20 miles southeast of Mount Whitney and directly opposite the northern part of the Kern River basin. The total length of Owens River is about 125 miles—45 miles above the lower end of the canyon and 80 miles in Owens Valley.

Owens River has many tributaries. More than forty lateral streams, many of them, however, comparatively small, drain a part of the eastern slope of the Sierra and enter the main stream from the west. The principal tributaries, from north to south, are as follows: Rock, Pine, Horton, McGee, Birch, and Bishop creeks, opposite the San Joaquin basin; Coyote, Baker, Big Pine, Birch, Tinemaha, Taboose, Goodale, Division, Sawmill (Eightmile), Thibaut, Oak, Pine, and Symmes creeks, opposite Kings River basin; and Shepard, Bairs (Moffett), George, Hogback, Lone Pine, Tuttle, Richter, Cottonwood, and Ash creeks, opposite Kern River basin. No drainage enters Owens River from the east except during exceptionally heavy rainstorms, which are rare.

The basin is long and comparatively narrow and its topography is varied. It comprises a rough east-side mountain slope 5 or 6 miles wide, a valley floor about 6 miles wide, and a west-side slope ranging from 6 to 10 miles or more in width. The west-side area is made up of a very rugged and precipitous mountain slope 4 or 5 miles wide, and a sloping alluvial plain composed of delta-fan surfaces ranging from 1 to 5 miles in width and lying at the foot of the mountains and west of the western margin of the valley. Owens Valley is smooth

and ranges in altitude from 3,600 feet at the south end to about 4,100 feet at the north end. The crest of the east-side range of mountains averages about 6,000 feet higher than the valley floor. The west-side plain consists of a porous granitic alluvium of considerable depth, and ranges in altitude from about 4,000 feet at the western valley margin to about 6,000 feet at the foot of the mountains. It has a fairly uniform slope of 400 to 600 feet to the mile. The eastern slope of the Sierra is very steep and rugged, and ranges in altitude from about 6,000 feet at the foot to 13,000 or 14,000 feet at the crest. The geologic formation is granitic.

The basin is rather poorly forested. The eastern slope is practically barren of vegetation, except in places a scanty desert growth. The western slope has a very slight soil covering and only a sparse timber growth, found chiefly along the water courses. All the western slope, a large part of the eastern slope, and the central part of Owens Valley are included in national forests.

The mean annual precipitation in Owens River basin is very light, especially on the valley floor and the eastern slope. The only records available are for the valley and indicate that the mean annual precipitation there is about 5 inches. On the Sierra slope the precipitation probably increases with increase of latitude and certainly increases with increase of altitude. On the higher parts of the slope it is probably 30 or 40 inches and possibly more; and it occurs almost entirely as snow, whose melting feeds the numerous streams that issue from this slope. These streams usually have their minimum flow in February and their maximum in July. Their combined maximum is about ten times their combined minimum. There is about the same ratio of disparity in the monthly extremes of precipitation, but the seasons are reversed.

Owens Valley is extensively cultivated and particularly adapted to stock raising. Numerous diversions are made for irrigation at different points on Owens River and tributaries, particularly in the upper part of the valley. Considerable water is also used for irrigating meadow lands in Long Valley north of Owens River canyon, but it is returned to the river above the head of Owens Valley.

Many excellent reservoir sites exist on the main stream and on the upper reaches of its tributaries.

The basin affords many opportunities for power development. The fall is so great and the minimum flow of the stream is so large and so reliably constant that many thousands of horsepower could be developed. It is estimated that a minimum of more than 100,000 horsepower could be obtained without storage, and this amount could be considerably more than doubled by utilizing all the possible storage. The Los Angeles Aqueduct, when completed, will have a capacity of 400 second-feet and a total fall of more than 3,000 feet from

its intake in Owens Valley to its outfall in San Fernando Valley near the city, and will generate more than 100,000 horsepower. A full development of all the power opportunities in Owens River basin would probably yield more than 300,000 horsepower continuously.

Considered as a source of water supply, Owens River basin has other features of special interest. Nearly all the streams rise in glacial lakelets and marshes which are located at high altitudes near the crest of the Sierra, and serve to a certain extent as storage reservoirs in regulating the flow. The streams emerge from the mouths of their canyons upon the porous alluvial plain at the base of the Sierra, which is 1 to 5 miles in width and several hundred feet deep and across which they flow to the Owens River channel in the trough of the valley. This belt of débris is the source of a large and important loss, part of which appears in numerous springs throughout the valley. Perhaps stronger evidence of the great loss by seepage is afforded by the broad belt of wet and somewhat boggy land which extends over a large part of the trough of the basin. Undoubtedly large quantities of water can be obtained by sinking wells within this area. Several artesian wells which have been sunk in the vicinity of Independence yield a strong flow and give convincing evidence of an artesian belt in the valley. With a view to the greatest ultimate utilization of the valley's water supply, the city of Los Angeles is conducting special investigations to determine the depth to and fluctuations in the ground-water plane and the rate of evaporation from free water surface and saturated gravels near Independence; also to determine the amount of precipitation on the alluvial plain at the base of the Sierra between the 4,000 and 6,000 feet contours and the seepage losses of creeks crossing it.

The longest run-off record in Owens River basin extends back to 1903, when stations were established on the main stream and on Rock and Pine creeks near Round Valley, and Bishop Creek near Bishop. The wettest year since that time was 1906 or 1907, and the driest 1905. The total flow during the wettest year was nearly double that during the driest.

The following gaging stations have been maintained in this basin:

Owens River near Round Valley (1903 to 1908).
Owens River near Tinemaha (1906 to 1908).
Rock Creek near Round Valley (1903 to 1908).
Pine Creek near Round Valley (1903 to 1908).
Bishop Creek near Bishop (1903 to 1908).
Baker Creek near Big Pine (1908).
Big Pine Creek near Big Pine (1903 to 1908).
Birch Creek near Tinemaha (1907 to 1908).
Tinemaha Creek near Tinemaha (1907 to 1908).
Taboose Creek near Tibbetts (1906 to 1908).
Goodale Creek near Tibbetts (1906 to 1908).
Division Creek near Tibbetts (1906 to 1908).

Sawmill Creek near Independence (1906 to 1908).
Thibaut Creek near Independence (1908).
Oak Creek near Independence (1905 to 1908).
Independence Creek near Independence (1905 to 1908).
Shepard Creek near Thebe (1906 to 1908).
Bairs Creek near Thebe (1906 to 1908).
George Creek near Thebe (1906 to 1908).
Lone Pine Creek near Lone Pine (1906 to 1908).
Tuttle Creek near Lone Pine (1906 to 1908).
Cottonwood Creek near Olancha (1906 to 1908).
Ash Creek near Olancha (1906 to 1908).

In the fall of 1903 stations were established on five or six of the principal streams in Owens Valley and on numerous diversion canals used for irrigation. These stations were maintained two or three years to obtain general statistical data on the water supply of Owens Valley, and also for the purpose of determining the quantity of water used for irrigation at that time and the suitability of the valley for a reclamation project. After the city of Los Angeles had acquired its extensive holdings in the valley and had taken active steps to utilize the flow of Owens River and tributaries for a municipal water supply, many other stations were established at the request of and in cooperation with the city. Since that time all stations in Owens Valley have been maintained in cooperation with the city of Los Angeles, the city paying all field and maintenance expenses and the National Government furnishing and paying an engineer to do the work.

All stations in Owens Valley, except those on Owens River, are located near the western margin of the valley, and most of them are below the delta fans which extend eastward from the mouths of the canyons and are above all diversions. Almost without exception measurements are made from footbridges or by wading. The current is swift at almost every station and the channel is subject to more or less change.

OWENS RIVER NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, at the footbridge, 700 feet above the junction of Owens River and Rock Creek, and was destroyed March 19, 1907. A new station was established May 29, 1907, about 100 feet below the old one, but the new gage was not referred to the old datum.

Discharge measurements of Owens River near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	G. R. Shuey	34	86	2.15	261
February 12	do	34	84	2.17	254
March 12	do	34	82	2.06	232
May 14	do	19	77	.....	350
August 4	Shuey and Post	21	101	3.25	709
August 8	R. B. Post	21	98	3.00	566
August 24	do	21	79	2.61	369
September 7	do	18	68	2.52	300
September 23	do	18	62	2.40	260
October 5	do	18	62	2.35	251
October 28	do	20	71	2.50	278
November 17	do	20	71	2.28	233
December 8	do	20	66	2.26	243
1908.					
February 22	R. B. Post	21	65	2.20	228
March 29	do	20	61	2.15	236
May 12	do	32	76	2.2	222
June 18	do	32	79	2.35	256
July 15	W. A. Lamb	34	84	2.38	267
August 4	do	35	92	2.45	311
August 25	do	33	80	2.15	240
September 17	do	34	77	2.1	220
October 8	do	33.5	73	1.95	198
October 23	Barrows and Lamb	33.5	76	2.00	200
November 7	do	32	75	2.00	187

NOTE.—Beginning August 4, 1907, the gage heights refer to the new gage established May 29, 1907.

Daily gage height, in feet, of Owens River near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	2.15	2.2	2.25	.....	.....	3.0	3.6	3.45	2.5	2.35	2.35	2.3
2	2.1	2.2	2.3	.....	.....	3.2	3.6	3.45	2.5	2.35	2.35	2.3
3	2.0	2.25	2.3	.....	.....	3.4	3.6	3.45	2.5	2.35	2.35	2.25
4	1.95	2.3	2.35	.....	.....	3.4	3.6	3.4	2.5	2.35	2.3	2.25
5	1.85	2.3	2.4	.....	.....	3.35	3.6	3.3	2.5	2.35	2.3	2.2
6	1.9	2.35	2.4	.....	.....	3.2	3.6	3.2	2.5	2.35	2.3	2.3
7	1.9	2.35	2.35	.....	.....	3.1	3.6	3.2	2.5	2.4	2.3	2.4
8	1.95	2.3	2.3	.....	.....	3.1	3.6	3.1	2.5	2.4	2.3	2.4
9	2.0	2.2	2.25	.....	.....	3.05	3.6	3.0	2.5	2.4	2.3	2.35
10	2.1	2.2	2.25	.....	.....	3.0	3.6	2.9	2.5	2.4	2.3	2.3
11	2.15	2.2	2.2	.....	.....	3.0	3.6	2.9	2.5	2.4	2.3	2.35
12	2.15	2.2	2.05	.....	.....	3.0	3.6	2.9	2.55	2.4	2.3	2.4
13	2.15	2.2	2.25	.....	.....	2.9	3.6	2.85	2.55	2.4	2.3	2.4
14	2.15	2.2	2.3	.....	.....	2.8	3.55	2.85	2.55	2.4	2.3	2.4
15	2.15	2.2	2.3	.....	.....	2.8	3.5	2.85	2.5	2.4	2.3	2.35
16	2.15	2.3	2.25	.....	.....	2.8	3.45	2.85	2.5	2.4	2.3	2.3
17	2.15	2.25	2.5	.....	.....	3.0	3.4	2.8	2.55	2.4	2.3	2.25
18	2.15	2.2	4.2	.....	.....	3.1	3.4	2.8	2.55	2.4	2.3	2.2
19	2.15	2.2	3.0	.....	.....	2.8	3.4	2.75	2.6	2.4	2.3	2.15
20	2.15	2.25	2.5	.....	.....	2.7	3.4	2.75	2.6	2.4	2.25	2.15
21	2.2	2.25	2.7	.....	.....	3.0	3.4	2.7	2.55	2.45	2.25	2.15
22	2.2	2.3	2.5	.....	.....	3.0	3.35	2.7	2.5	2.5	2.25	2.15
23	2.2	2.35	2.5	.....	.....	3.1	3.3	2.65	2.4	2.55	2.25	2.15
24	2.15	2.25	2.4	.....	.....	3.0	3.25	2.6	2.4	2.5	2.25	2.15
25	2.15	2.2	2.4	.....	.....	3.0	3.3	2.6	2.4	2.5	2.25	2.15
26	2.15	2.15	2.4	.....	.....	3.1	3.35	2.6	2.4	2.5	2.25	2.15
27	2.15	2.15	2.4	.....	.....	3.25	3.4	2.55	2.4	2.5	2.3	2.2
28	2.2	2.2	2.4	.....	.....	3.3	3.4	2.55	2.4	2.5	2.3	2.3
29	2.2	.....	2.4	.....	2.8	3.35	3.4	2.5	2.4	2.5	2.3	2.25
30	2.25	.....	2.4	.....	2.9	4.0	3.4	2.5	2.4	2.45	2.3	2.2
31	2.2	.....	2.4	.....	3.0	.....	3.45	2.5	.....	2.4	.....	2.2

[a] Gage destroyed March 19, 1907. Gage heights March 21 to 31, inclusive, estimated by comparison with Rock and Pine creeks. New gage established May 29 about 100 feet below old station.

Daily gage height, in feet, of Owens River near Round Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.2	2.2	2.2	2.15	2.3	2.4	2.4	2.5	2.2	2.0	.....	.....
2	2.2	2.2	2.2	2.15	2.4	2.4	2.4	2.5	.....	2.1	2.0	1.95
3	2.2	2.2	2.15	2.15	2.6	2.4	.....	2.6	2.2	.....	.....	.....
4	2.2	2.2	2.15	2.15	2.5	2.5	2.5	2.5	.....	2.1	2.0	2.0
5	2.15	2.15	2.15	2.15	2.3	2.4	2.6	2.5	2.2	.....	.....	.....
6	2.15	2.15	2.1	2.15	2.5	2.6	2.4	2.5	2.2	2.1	1.95	2.0
7	2.15	2.1	2.1	2.15	2.4	2.65	2.4	2.6	.....	.....	.....	.....
8	2.15	2.1	2.1	2.1	2.4	2.7	2.45	2.6	2.2	1.95	1.95	2.0
9	2.15	2.1	2.1	2.1	2.4	2.6	2.4	2.4	2.2	1.95	.....	.....
10	2.15	2.1	2.1	2.1	2.3	2.4	2.5	2.35	.....	2.0	1.95	1.95
11	2.2	2.1	2.2	2.1	2.3	2.4	2.5	2.3	2.3	2.0	.....	.....
12	2.2	2.1	2.3	.....	2.3	2.5	2.6	2.3	2.3	.....	1.95	1.95
13	2.15	2.1	2.7	.....	2.3	2.5	2.5	2.35	2.2	2.0	.....	.....
14	2.15	2.1	2.75	2.2	2.4	2.5	2.6	2.3	.....	.....	2.0	1.9
15	2.1	2.1	2.8	2.3	2.3	.....	2.5	2.35	2.2	2.0	.....	.....
16	2.1	2.1	2.8	.....	2.3	.....	2.5	2.4	2.15	.....	1.95	1.95
17	2.1	2.1	2.75	2.3	2.4	2.6	2.4	2.3	2.1	2.0	.....	.....
18	2.1	2.15	2.7	2.3	2.3	2.6	2.4	2.2	2.25	.....	1.95	1.9
19	2.15	2.15	2.7	2.4	2.3	2.4	2.4	2.3	2.2	2.0	.....	.....
20	2.15	2.2	2.7	2.6	2.3	2.35	2.3	2.25	.....	.....	1.95	1.9
21	2.15	2.2	2.6	2.3	2.3	2.5	2.3	2.2	2.25	2.0	.....	.....
22	2.2	2.2	2.5	2.3	2.4	2.55	2.4	2.2	.....	.....	1.95	1.95
23	2.2	2.2	2.4	2.3	2.5	2.4	2.3	2.2	.....	2.0	.....	.....
24	2.25	2.2	2.3	2.3	2.4	2.45	2.3	2.2	2.0	.....	1.95	1.95
25	2.3	2.2	2.2	2.3	2.4	2.6	2.3	.....	2.0	1.95	.....	.....
26	2.3	2.2	2.2	2.2	2.5	2.65	2.4	.....	.....	.....	1.95	1.95
27	2.25	2.25	2.2	2.4	2.5	2.6	.....	2.2	2.0	2.0	.....	.....
28	2.25	2.25	2.15	2.4	2.4	2.5	2.4	2.2	.....	.....	1.95	1.95
29	2.2	2.25	2.15	2.3	2.3	2.5	2.5	2.2	2.0	1.95	.....	.....
30	2.2	.....	2.15	2.4	2.4	2.55	2.4	2.2	.....	.....	1.95	1.95
31	2.2	.....	2.15	.....	2.4	.....	2.5	2.2	.....	2.0	.....	1.95

Rating tables for Owens River near Round Valley, Cal.

JANUARY 1, 1906, TO MARCH 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	132	2.30	297	3.00	512	3.70	750
1.70	152	2.40	326	3.10	545	3.80	785
1.80	172	2.50	355	3.20	578	3.90	821
1.90	194	2.60	385	3.30	612	4.00	857
2.00	218	2.70	416	3.40	646	4.10	893
2.10	244	2.80	448	3.50	680	4.20	930
2.20	270	2.90	480	3.60	715		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1903 to 1907, and is well defined between gage heights 1.7 feet and 2.8 feet.

MAY 29, 1907, TO DECEMBER 31, 1908.

1.90	174	2.50	307	3.10	617	3.60	932
2.00	191	2.60	342	3.20	679	3.70	997
2.10	210	2.70	386	3.30	741	3.80	1,062
2.20	231	2.80	441	3.40	804	3.90	1,127
2.30	253	2.90	498	3.50	868	4.00	1,192
2.40	278	3.00	557				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 21 discharge measurements made from August, 1907, to December 31, 1908. It is fairly well defined between gage heights 1.9 feet and 3.3 feet.

Monthly discharge of Owens River near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	284	183	247	15,200	A.
February	312	257	281	15,600	A.
March	929	231	341	21,000	B.
April	.....	.....	270	16,100	D.
May	.....	.....	438	26,900	D.
June	1,190	387	616	36,700	B.
July	932	710	856	52,600	B.
August	836	307	432	26,600	B.
September	342	278	305	18,100	B.
October	324	266	285	17,500	B.
November	266	242	252	15,000	B.
December	278	220	245	15,100	B.
The year	1,190	183	381	276,000	
1908.					
January	253	210	227	14,000	B.
February	242	210	223	12,800	B.
March	441	210	279	17,200	B.
April	342	210	242	14,400	B.
May	342	253	274	16,800	B.
June	386	266	313	18,600	B.
July	342	253	289	17,800	B.
August	342	231	264	16,200	B.
September	253	191	222	13,200	B.
October	210	182	192	11,800	B.
November	191	182	184	10,900	B.
December	191	174	182	11,200	B.
The year	441	174	241	175,000	

NOTE.—Monthly mean for April and May, 1907, estimated. Discharges interpolated for days in 1908 when gage was not read.

OWENS RIVER NEAR TINEMAHA, CAL.

This station was regularly established September 20, 1906, but the city of Los Angeles had made frequent measurements since the beginning of 1906. It is located at a basaltic knoll in the floor of the valley, known as Charlies Butte, about 7 miles south of Tinemaha. Measurements are made from a cable.

When the discharge exceeds 1,800 second-feet the left bank overflows and the station is inaccessible. At such times measurements are made from the county bridge near Citrus, about 12 miles below.

The bed of the stream is composed of sand and gravel and is subject to some change between high and low water.

The gage was washed out March 22, 1907, and a new one installed at the same datum on March 30, 1907.

Discharge measurements of Owens River near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 21	G. R. Shuey	82	227	2.62	497
February 7	do	82	234	2.72	544
February 20	do	83	223	2.55	505
March 6	do	83	276	3.47	704
March 30	do	84	234	2.85	536
April 12	do	84	167	1.85	345
April 20	do	64	120	1.33	221
May 3	do	58	98	.80	169
May 17	do	68	133	1.38	253
June 12	do	85	284	3.60	694
June 29	do	85	300	3.71	745
July 7	do	80	524	7.25	1,690
July 11	do	80	440	.....	1,360
August 2	do	83	378	4.90	1,060
August 11	R. B. Post	83	284	3.79	748
August 15	do	83	260	3.29	649
August 31	do	79	167	2.25	381
September 12	do	68	149	1.82	327
September 25	do	63	138	1.55	264
October 21	do	82	223	2.56	463
October 30	do	84	280	3.50	652
November 12	do	84	214	2.92	476
November 25	do	83	226	2.72	481
December 4	do	83	220	2.69	439
1908.					
February 7	R. B. Post	85	270	3.27	677
Do	do	85	270	3.27	675
March 17	do	85	279	3.26	657
March 25	do	83	191	2.35	410
April 8	do	57	109	1.13	181
April 20	do	45	73	.70	115
April 29	do	40	51	.32	62
May 2	do	40	47	.24	52
May 16	do	40	45	.22	56
May 22	do	40	46	.20	58
June 2	do	40	53	.36	71
June 12	do	40	38	.06	54
June 26	do	40	41	.20	60
July 8	do	53	104	1.40	209
July 17	W. A. Lamb	69	122	1.65	275
July 29	do	58	90	.90	168
August 5	do	86	188	2.52	467
August 14	do	85	142	1.77	286
August 28	do	50	74	.80	131
September 20	do	85	106	1.35	224
September 28	do	85	127	1.60	270
October 9	do	83	121	1.52	256
October 24	Barrows and Lamb	86	188	2.13	436
November 5	A. T. Barrows	87	196	2.27	397
November 15	do	87	195	2.24	392
November 27	C. H. Lee	86	179	2.18	370

Daily gage height, in feet, of Owens River near Tinemaha, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	3.05	2.3	2.9	0.9	2.0	4.5	5.0	2.2	1.6	3.3	2.7
2	2.65	3.0	2.25	2.9	.85	2.5	5.0	4.9	2.1	1.65	3.2	2.7
3	2.6	3.0	2.3	2.85	.8	2.9	5.6	4.8	2.05	1.7	3.15	2.7
4	2.5	2.95	2.35	2.7	.75	3.1	6.05	4.75	2.0	1.75	3.1	2.7
5	2.45	2.9	2.85	2.6	.85	3.6	6.5	4.8	1.95	1.8	3.05	2.75
6	2.5	2.95	3.45	2.5	1.0	3.9	6.9	4.85	1.9	1.9	3.0	2.8
7	2.55	3.0	3.3	2.4	1.15	3.95	7.25	4.65	1.85	2.05	3.0	2.9
8	2.6	3.0	3.05	2.2	1.25	3.9	7.35	4.45	1.8	2.1	3.0	3.1
9	2.7	3.0	2.8	2.1	1.3	3.8	7.3	4.2	1.75	2.2	3.0	3.05
10	2.8	2.9	2.65	2.0	1.3	3.7	7.2	4.0	1.75	2.25	3.0	3.05
11	2.85	2.8	2.5	1.9	1.35	3.6	6.75	3.75	1.8	2.2	2.95	3.2
12	2.95	2.7	2.4	1.8	1.3	3.6	6.65	3.7	1.8	2.15	2.9	3.15
13	3.0	2.6	2.35	1.7	1.3	3.55	6.6	3.5	1.85	2.1	2.9	3.0
14	2.95	2.5	2.35	1.6	1.3	3.55	5.9	3.4	1.9	2.15	2.9	3.0
15	2.9	2.4	2.4	1.7	1.3	3.5	5.8	3.3	1.8	2.2	2.85	2.9
16	2.85	2.3	2.35	1.75	1.25	3.5	5.7	3.25	1.7	2.3	2.8	2.85
17	2.8	2.4	2.45	1.65	1.4	3.4	5.6	3.2	1.65	2.4	2.8	2.8
18	2.75	2.55	3.0	1.55	1.45	3.3	5.5	3.25	1.6	2.5	2.8	2.8
19	2.7	2.45	4.0	1.4	1.55	3.3	5.4	3.3	1.6	2.6	2.8	2.8
20	2.7	2.55	4.9	1.3	1.7	3.1	5.2	3.2	1.6	2.6	2.8	2.75
21	2.7	2.6	6.0	1.25	1.8	3.05	5.0	3.1	1.6	2.6	2.8	2.75
22	2.6	2.6	[a] 5.6	1.2	1.85	3.0	4.9	3.0	1.6	2.7	2.8	2.75
23	2.5	2.65	[a] 5.2	1.15	1.9	3.0	4.8	2.9	1.6	2.85	2.75	2.7
24	2.5	2.6	[a] 4.8	1.1	1.9	3.15	4.75	2.85	1.55	3.05	2.75	2.7
25	2.55	2.55	[a] 4.4	1.0	1.85	3.3	4.9	2.7	1.55	3.3	2.75	2.7
26	2.6	2.5	[a] 4.1	.9	1.85	3.5	5.1	2.6	1.55	3.15	2.75	2.75
27	2.7	2.45	[a] 3.8	.8	1.85	3.65	5.3	2.55	1.55	3.1	2.75	2.75
28	2.8	2.4	[a] 3.5	.85	1.85	3.8	5.25	2.5	1.55	3.7	2.75	3.0
29	2.9	.....	[a] 3.1	.9	1.9	3.9	5.2	2.4	1.55	3.6	2.75	2.95
30	3.0	.....	2.85	.9	1.95	4.0	5.15	2.3	1.55	3.5	2.75	2.85
31	3.1	.....	2.9	.....	2.0	.....	5.1	2.25	.....	3.4	.....	2.75
1908.												
1	2.75	2.95	2.8	1.55	.25	.3	.5	1.4	.6	1.55	2.25	2.25
2	2.7	3.1	2.75	1.45	.25	.25	.55	1.5	.6	1.55	2.25	2.3
3	2.7	3.3	2.7	1.35	.2	.25	.6	1.6	.55	1.4	2.25	2.4
4	2.7	3.45	2.6	1.3	.2	.3	.7	2.2	.5	1.5	2.3	2.5
5	2.7	3.55	2.6	1.25	.25	.25	.85	2.6	.45	1.55	2.25	2.55
6	2.7	3.4	2.6	1.2	.3	.2	1.0	3.0	.4	1.6	2.25	2.5
7	2.7	3.25	2.55	1.15	.2	.2	1.35	3.05	.5	1.6	2.25	2.45
8	2.7	3.1	2.55	1.15	.2	.2	1.4	2.8	.55	1.55	2.2	2.45
9	2.65	3.05	2.55	1.15	.2	.1	1.3	2.6	.6	1.55	2.25	2.4
10	2.65	3.1	2.55	1.2	.2	.1	1.4	2.45	.9	1.5	2.25	2.4
11	2.7	3.05	2.55	1.25	.2	.05	1.6	2.4	1.1	1.5	2.2	2.35
12	2.7	3.0	2.55	1.15	.2	.0	1.6	2.15	1.0	1.5	2.2	2.3
13	2.75	2.9	2.6	1.1	.2	− .05	1.7	2.0	1.1	1.55	2.25	2.3
14	2.8	2.8	2.6	1.05	.2	− .05	1.7	1.8	1.1	1.6	2.25	2.25
15	2.8	2.7	2.8	1.0	.25	− .05	1.75	1.65	1.15	1.6	2.25	2.25
16	2.8	2.7	3.0	.9	.25	− .05	1.8	1.55	1.2	1.65	2.25	2.2
17	2.75	2.7	3.25	.75	.2	+ .4	1.65	1.5	1.2	1.7	2.25	2.2
18	2.7	2.7	3.4	.75	.25	.5	1.4	1.35	1.25	1.7	2.2	2.15
19	2.7	2.7	3.4	.7	.25	.4	1.25	1.2	1.3	1.7	2.2	2.1
20	2.7	2.7	3.15	.8	.2	.3	1.1	1.05	1.35	1.8	2.2	2.0
21	2.7	2.7	2.9	.65	.2	.2	1.1	.9	1.35	1.9	2.2	2.05
22	2.7	2.8	2.7	.5	.2	.2	1.05	.9	1.3	2.0	2.25	2.1
23	2.8	3.2	2.5	.5	.2	.15	1.0	.85	1.3	2.05	2.25	2.2
24	3.0	3.1	2.4	.45	.2	.15	.9	.8	1.35	2.1	2.25	2.2
25	3.0	2.9	2.3	.4	.25	.2	.9	.75	1.4	2.1	2.2	2.2
26	3.0	2.85	2.2	.4	.3	.2	.8	.75	1.5	2.1	2.2	2.2
27	3.05	2.8	2.1	.35	.2	.2	.7	.8	1.6	2.1	2.2	2.25
28	3.1	2.75	1.95	.35	.2	.3	.75	.8	1.5	2.1	2.2	2.25
29	3.05	2.75	1.85	.3	.2	.3	.9	.8	1.5	2.15	2.25	2.3
30	3.0	.....	1.75	.3	.2	.4	1.1	.7	1.55	2.2	2.25	2.3
31	3.0	.....	1.65	.....	.25	.....	1.25	.6	.....	2.2	.....	2.3

[a] Estimated.

Rating tables for Owens River near Tinemaha, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	159	2.00	355	3.30	631	5.20	1,131
.80	170	2.10	373	3.40	655	5.40	1,185
.90	181	2.20	391	3.50	680	5.60	1,239
1.00	194	2.30	410	3.60	705	5.80	1,293
1.10	208	2.40	430	3.70	731	6.00	1,347
1.20	222	2.50	451	3.80	757	6.20	1,401
1.30	238	2.60	472	3.90	783	6.40	1,455
1.40	254	2.70	494	4.00	809	6.60	1,509
1.50	270	2.80	516	4.20	861	6.80	1,563
1.60	286	2.90	538	4.40	915	7.00	1,617
1.70	302	3.00	561	4.60	969	7.20	1,672
1.80	319	3.10	584	4.80	1,023	7.40	1,728
1.90	337	3.20	607	5.00	1,077		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 24 discharge measurements made during 1907 and is fairly well defined.

FOR 1908.

0.00	40	1.00	159	2.00	346	3.00	592
.10	47	1.10	175	2.10	367	3.10	619
.20	56	1.20	191	2.20	390	3.20	646
.30	66	1.30	209	2.30	413	3.30	674
.40	77	1.40	227	2.40	437	3.40	702
.50	89	1.50	245	2.50	462	3.50	730
.60	102	1.60	264	2.60	487	3.60	758
.70	115	1.70	284	2.70	513		
.80	129	1.80	304	2.80	539		
.90	143	1.90	325	2.90	565		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 26 discharge measurements made during 1908 and is well defined.

Monthly discharge of Owens River near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	584	440	500	30,700	B.
February	572	410	493	27,400	B.
March	1,350	400	646	39,700	B.
April	538	170	315	18,700	B.
May	355	164	264	16,200	B.
June	809	355	660	39,300	B.
July	1,710	942	1,280	78,600	B.
August	1,080	400	698	42,900	B.
September	391	278	310	18,400	B.
October	731	286	460	28,300	B.
November	631	505	538	32,000	B.
December	607	494	527	32,400	B.
The year	1,710	164	558	405,000	
1908.					
January	619	500	539	33,100	B.
February	744	513	584	33,600	B.
March	702	274	485	29,800	C.
April	255	66	145	8,630	B.
May	66	56	58.1	3,570	B.
June	89	36	56.9	3,390	B.
July	304	89	188	11,600	B.
August	605	102	274	16,800	B.
September	264	77	173	10,300	B.
October	390	227	298	18,300	B.
November	413	390	397	23,600	B.
December	474	346	409	25,100	B.
The year	744	36	300	218,000	

ROCK CREEK NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, at the wagon bridge on the Bishop and Long Valley road, about two-thirds of a mile above the mouth of the creek.

Discharge measurements of Rock Creek near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	G. R. Shuey	14	20	1.75	44
February 11	do	13	17	1.50	36
March 12	do	11	13	1.23	23
April 26	do	15	19	1.60	42
May 15	do	14	22	1.85	54
May 30	do	14	29	2.40	84
July 3	do	14	38	3.10	132
July 24	do	14	36	2.90	122
August 4	Shuey and Post	14	34	2.80	107
August 8	R. B. Post	14	29	2.40	85
August 24	do	14	24	1.95	59
September 7	do	14	20	1.75	47
September 23	do	13	16	1.50	33
October 5	do	13	16	1.55	35
October 28	do	14	22	1.85	54
November 17	do	14	18	1.65	39
December 8	do	13	17	1.50	33
1908.					
February 22	R. B. Post	14	25	2.15	70
March 29	do	12	12	1.19	23
May 12	do	12	12	1.15	22
June 18	do	12	12	1.25	25
July 15	W. A. Lamb	14	19	1.43	40
August 4	do	15	27	2.00	73
August 26	do	13	17	1.25	33
September 17	do	14	18	1.46	35
October 7	do	14.5	16	1.39	29
October 22	A. T. Barrows	14	16	1.35	31
November 6	do	14.5	9.3	1.23	16
November 26	Barrows and Lee	14.5	15	1.30	25

Daily gage height, in feet, of Rock Creek near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.6	1.6	1.45	1.55	1.65	3.0	3.9	2.8	1.7	1.55	1.75	1.5
2	1.6	1.6	1.5	1.5	1.65	3.2	3.8	2.8	1.7	1.55	1.75	1.5
3	1.55	1.6	1.5	1.5	1.7	3.2	3.8	2.8	1.7	1.55	1.7	1.4
4	1.55	1.55	1.8	1.5	1.7	3.2	3.8	2.7	1.75	1.55	1.7	1.45
5	1.5	1.55	2.1	1.45	1.75	3.1	3.8	2.6	1.75	1.55	1.7	1.4
6	1.5	1.55	2.0	1.4	1.75	3.0	3.8	2.6	1.75	1.55	1.65	1.7
7	1.55	1.55	1.6	1.35	1.8	2.9	3.85	2.6	1.75	1.5	1.65	1.8
8	1.6	1.6	1.55	1.3	1.85	2.8	3.85	2.55	1.75	1.5	1.6	1.75
9	1.65	1.6	1.5	1.35	1.9	2.6	3.85	2.5	1.75	1.5	1.6	1.7
10	1.65	1.65	1.5	1.4	1.9	2.5	3.9	2.4	1.7	1.4	1.65	1.65
11	1.7	1.65	1.5	1.4	1.9	2.5	3.9	2.35	1.7	1.4	1.65	1.65
12	1.7	1.6	1.2	1.45	1.95	2.5	3.9	2.3	1.7	1.35	1.6	1.6
13	1.7	1.6	1.2	1.45	2.0	2.3	3.9	2.25	1.65	1.35	1.6	1.6
14	1.7	1.6	1.25	1.5	2.1	2.2	3.9	2.25	1.65	1.4	1.6	1.6
15	1.7	1.6	1.4	1.5	2.1	2.0	3.85	2.3	1.6	1.5	1.65	1.5
16	1.7	1.6	1.4	1.5	2.1	2.0	3.8	2.3	1.6	1.7	1.65	1.45
17	1.7	1.55	1.8	1.5	2.15	1.9	3.8	2.4	1.65	1.7	1.65	1.4
18	1.75	1.55	2.1	1.5	2.2	1.8	3.8	2.35	1.65	1.65	1.65	1.4
19	1.75	1.5	1.9	1.5	2.2	2.0	3.6	2.3	1.7	1.6	1.65	1.35
20	1.7	1.5	1.8	1.5	2.3	2.0	3.4	2.25	1.7	1.7	1.7	1.35

Daily gage height, in feet, of Rock Creek near Round Valley, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	1.65	1.5	1.9	1.5	2.3	2.5	3.2	2.2	1.65	2.2	1.7	1.35
22	1.65	1.5	1.7	1.5	2.35	2.5	3.0	2.2	1.6	2.25	1.7	1.3
23	1.65	1.5	1.7	1.5	2.4	2.6	2.8	2.15	1.5	2.3	1.7	1.3
24	1.65	1.45	1.65	1.5	2.45	2.6	2.6	2.1	1.5	2.25	1.7	1.3
25	1.65	1.4	1.65	1.5	2.5	2.4	2.6	2.0	1.5	2.0	1.7	1.3
26	1.65	1.35	1.65	1.55	2.6	2.5	2.7	1.9	1.5	1.85	1.7	1.35
27	1.65	1.35	1.6	1.6	2.7	2.6	2.8	1.8	1.5	1.85	1.65	1.4
28	1.65	1.4	1.6	1.6	2.8	2.9	2.9	1.75	1.5	1.85	1.6	1.4
29	1.6	.....	1.6	1.6	2.9	3.6	2.9	1.7	1.5	1.85	1.55	1.4
30	1.6	.....	1.6	1.6	3.0	4.0	2.85	1.6	1.5	1.8	1.5	1.45
31	1.6	.....	1.55	.....	3.0	.....	2.85	1.6	.....	1.8	.....	1.5
1908.												
1	1.5	1.5	1.4	1.2	1.5	1.3	1.8	1.7	1.2	1.4	.....	.....
2	1.45	1.5	1.4	1.2	1.4	1.3	1.7	2.0	.....	1.4	1.2	1.2
3	1.45	1.45	1.4	1.2	1.3	1.2	.....	2.0	1.2	.....	.....	.....
4	1.45	1.4	1.4	1.2	1.4	1.2	1.75	1.9	.....	1.35	1.15	1.3
5	1.45	1.35	1.4	1.2	1.15	1.3	1.8	1.9	1.25	.....	.....	.....
6	1.5	1.3	1.4	1.2	1.5	1.4	1.7	2.0	1.2	1.4	1.2	1.3
7	1.5	1.3	1.4	1.2	1.0	1.4	1.8	2.0	.....	.....	.....	.....
8	1.5	1.25	1.4	1.15	1.3	1.4	1.9	1.9	1.2	1.4	1.2	1.25
9	1.5	1.25	1.4	1.15	1.2	1.4	1.85	2.0	1.2	.....	.....	.....
10	1.5	1.3	1.4	1.15	1.3	1.4	2.0	2.0	.....	.....	1.2	1.2
11	1.5	1.3	1.4	1.2	1.1	1.4	1.85	2.0	1.1	1.3	.....	.....
12	1.4	1.3	1.4	.....	1.1	1.3	2.0	1.9	1.15	.....	1.2	1.3
13	1.35	1.35	1.4	.....	1.2	1.5	1.9	2.1	1.2	1.0	.....	.....
14	1.2	1.4	1.35	1.0	1.1	1.3	2.0	2.0	.....	.....	1.2	1.3
15	1.2	1.4	1.35	1.0	1.3	1.4	1.8	1.8	1.35	1.0	.....	.....
16	1.15	1.4	1.35	1.0	1.2	1.45	1.7	1.9	.....	.....	1.15	1.25
17	1.15	1.4	1.4	1.0	1.3	1.5	1.7	1.8	.....	1.3	.....	.....
18	1.15	1.4	1.4	1.0	1.2	1.4	1.6	1.5	1.4	.....	1.2	1.3
19	1.2	1.4	1.4	1.1	1.2	1.4	1.6	1.4	1.45	1.1	.....	.....
20	1.2	1.35	1.35	1.1	1.3	1.4	1.5	1.3	.....	.....	1.2	1.3
21	1.2	1.35	1.3	1.1	1.3	1.5	1.4	1.2	1.5	1.2	.....	.....
22	1.3	1.7	1.25	1.0	1.3	1.5	1.4	1.2	.....	.....	1.15	1.3
23	1.3	1.45	1.25	1.1	1.3	1.35	1.3	1.2	1.6	.....	.....	.....
24	1.3	1.45	1.2	1.2	1.4	1.4	1.2	.....	1.7	.....	1.15	1.3
25	1.35	1.4	1.15	1.2	1.3	1.5	1.3	.....	1.7	1.25	.....	.....
26	1.4	1.4	1.1	1.2	1.3	1.5	1.3	.....	.....	.....	1.1	1.3
27	1.4	1.4	1.05	1.3	1.3	1.45	.....	1.2	1.6	1.2	.....	.....
28	1.4	1.4	1.2	1.3	1.3	1.4	1.4	1.3	.....	.....	1.15	1.3
29	1.4	1.4	1.2	1.3	1.2	1.4	1.5	1.3	1.5	1.1	.....	.....
30	1.45	.....	1.2	1.4	1.3	1.45	1.7	.....	.....	.....	1.2	1.3
31	1.5	.....	1.2	.....	1.3	.....	1.7	1.2	.....	1.2	.....	1.3

Rating tables for Rock Creek near Round Valley, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	22	2.00	61	2.80	111	3.60	167
1.30	26	2.10	67	2.90	118	3.70	174
1.40	30	2.20	73	3.00	125	3.80	181
1.50	34	2.30	79	3.10	132	3.90	188
1.60	39	2.40	85	3.20	139	4.00	195
1.70	44	2.50	91	3.30	146		
1.80	49	2.60	97	3.40	153		
1.90	55	2.70	104	3.50	160		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 17 discharge measurements made during 1907. It is fairly well defined between gage heights 1.2 feet and 3.1 feet. Above gage height 2.6 feet the rating curve is a tangent, the difference being 7 per tenth.

Rating tables for Rock Creek near Round Valley, Cal.—Continued.

FOR 1908.

[The daily discharges were obtained by the indirect method for shifting channels.]

Monthly discharge of Rock Creek near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	46	34	41.1	2,530	C.
February	42	28	36.0	2,000	C.
March	67	22	40.7	2,500	C.
April	39	26	33.5	1,990	C.
May	125	42	72.6	4,460	C.
June	195	49	101	6,010	C.
July	188	97	157	9,650	C.
August	111	39	77.6	4,770	C.
September	46	34	40.9	2,430	C.
October	79	28	44.6	2,740	C.
November	46	34	41.9	2,490	C.
December	49	26	33.6	2,070	C.
The year	195	22	60.0	43,600	
1908.					
January	35	22	29	1,780	D.
February	45	24	30	1,730	D.
March	30	18	27	1,660	D.
April	30	17	22	1,310	D.
May	35	17	25	1,540	D.
June	35	23	30	1,790	D.
July	73	31	52	3,200	D.
August	80	31	53	3,260	D.
September	49	28	36	2,140	D.
October	31	17	25	1,540	D.
November	23	21	22	1,310	D.
December	26	23	26	1,600	D.
The year	80	17	31	22,900	

NOTE.—The daily discharges for 1908 were obtained by the indirect method for shifting channels.

PINE CREEK NEAR ROUND VALLEY, CAL.

This station was originally established August 3, 1903, at a point about 100 feet above the mouth of the creek, and 150 feet below the bridge on the road from Bishop to Long Valley. It was reestablished May 13, 1908, at a point about 300 feet above the bridge, and 550 feet from the mouth of the creek. Gage heights after that date are not comparable with any previous records.

Discharge measurements of Pine Creek near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 13	G. R. Shuey	12	17	2.95	11
March 12	do	12	17	2.95	9.1
April 26	do	12	16	3.00	13
May 15	do	12	16	3.05	13
May 30	do	12	30	3.60	53
July 3	do	12	46	4.70	213
July 24	do	21	39	4.20	182
August 4	Shuey and Post	20	34	4.00	138
August 24	R. B. Post	18	22	3.48	52
September 7	do	17	20	3.30	41
September 23	do	19	14	3.05	22
October 5	do	16	13	2.98	18
November 17	do	14	11	2.89	13
1908.					
February 22	R. B. Post	9	14	3.02	17
March 29	do	7	10	2.69	5.9
May 13	do	7	10	3.48	4.4
June 18	do	8	13	3.87	20
July 15	Post and Lamb	10	19	4.19	50
August 3	W. A. Lamb	10	21	4.32	67
August 25	do	9	10	3.38	3.8
September 16	do	9	13	3.60	10
October 7	do	9	13	3.60	9.7
October 22	A. T. Barrows	9	12	3.51	6.6
November 6	do		12	3.49	5.6
November 26	Barrows and Lee	9	11.6	3.45	4.9

NOTE.—Beginning May 13, 1908, the gage heights refer to the new gage.

Daily gage height, in feet, of Pine Creek near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.95	3.0	2.95	2.95	3.0	4.0	4.8	4.3	3.4	3.0	3.0	2.9
2	2.95	3.0	2.95	2.95	3.0	4.1	4.7	4.3	3.4	3.0	3.0	2.9
3	2.95	3.0	2.95	3.0	3.0	4.2	4.7	4.3	3.4	3.0	3.0	2.9
4	2.95	3.0	3.1	3.0	3.0	4.3	4.65	4.2	3.35	3.0	3.0	2.9
5	2.95	3.0	3.3	3.0	3.0	4.3	4.65	4.1	3.35	3.0	2.9	2.9
6	2.95	3.0	3.2	2.95	3.0	4.2	4.6	4.0	3.3	3.0	2.85	2.95
7	2.95	3.0	3.1	2.95	3.0	4.1	4.6	4.0	3.3	3.0	2.85	2.95
8	2.95	3.0	3.1	2.95	2.95	4.05	4.5	3.9	3.3	3.0	2.8	2.95
9	2.9	3.0	3.0	3.0	2.9	4.0	4.4	3.9	3.3	3.0	2.8	2.9
10	2.9	3.0	3.1	3.0	2.9	4.0	4.4	3.8	3.25	3.0	2.85	2.9
11	2.9	3.0	3.2	3.0	2.9	3.9	4.3	3.75	3.2	3.0	2.9	2.9
12	2.9	3.0	2.95	3.0	3.0	3.8	4.3	3.7	3.2	3.0	3.0	2.9
13	2.9	3.0	2.9	3.0	3.1	3.8	4.3	3.75	3.2	3.0	3.0	2.85
14	2.9	3.0	2.9	3.0	3.2	3.7	4.4	3.75	3.2	3.0	2.9	2.85
15	2.9	3.0	2.85	3.0	3.25	3.5	4.35	3.8	3.2	3.0	2.9	2.85
16	2.9	3.0	2.95	3.0	3.3	3.2	4.3	3.8	3.2	3.0	2.9	2.85
17	2.9	3.0	2.9	3.0	3.3	3.0	4.2	3.8	3.2	3.0	2.9	2.85
18	2.95	3.0	3.1	3.0	3.4	3.0	4.2	3.8	3.2	3.0	2.9	2.85
19	2.95	3.0	3.1	3.0	3.4	3.7	4.2	3.8	3.15	3.0	2.9	2.85
20	2.95	3.0	3.1	3.0	3.4	3.65	4.25	3.75	3.1	3.0	2.9	2.85
21	3.0	3.0	3.1	3.0	3.35	4.0	4.25	3.7	3.1	3.05	2.9	2.85
22	3.0	3.0	3.0	3.0	3.35	4.0	4.3	3.7	3.05	3.05	2.9	2.9
23	3.0	3.0	3.0	3.0	3.3	4.1	4.3	3.6	3.05	3.1	2.9	2.9
24	3.0	2.95	3.0	3.0	3.3	4.0	4.3	3.5	3.05	3.05	2.9	2.9
25	3.0	2.95	3.0	3.0	3.3	4.0	4.2	3.5	3.1	3.0	2.9	2.9
26	3.0	2.9	3.0	3.0	3.4	4.1	4.15	3.45	3.1	3.0	2.9	2.9
27	3.0	2.9	3.0	3.0	3.5	4.45	4.1	3.4	3.05	2.95	2.9	2.9
28	3.0	2.95	3.0	3.0	3.6	4.7	4.1	3.4	3.0	2.95	2.9	2.9
29	3.0	.....	3.0	3.0	3.7	4.9	4.2	3.4	3.0	3.0	2.9	2.85
30	3.0	.....	3.0	3.0	3.8	5.0	4.2	3.4	3.0	3.0	2.9	2.85
31	3.0	.....	3.0	.....	4.0	.....	4.25	3.4	.....	3.0	.....	2.85

Daily gage height, in feet, of Pine Creek near Round Valley, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.9	2.75	2.7	2.8	2.3	3.4	3.9	4.4	3.4	3.7	.....	.....
2	2.9	2.75	2.7	2.75	2.4	3.4	3.95	4.4	.....	3.7	3.5	3.4
3	2.9	2.75	2.7	2.7	*a* 2.4	3.4	4.0	4.4	3.4	.....	.....	.....
4	2.9	2.75	2.75	2.7	*a* 2.4	3.5	4.0	4.4	.....	3.65	3.45	3.4
5	2.9	2.75	2.75	2.7	*a* 2.4	3.4	4.2	4.3	3.4	.....	.....	.....
6	2.9	2.75	2.7	2.7	*a* 2.4	3.6	4.3	4.3	3.4	3.5	3.45	3.4
7	2.85	2.7	2.7	2.7	*a* 2.4	3.6	4.3	4.4	.....	.....	.....	.....
8	2.85	2.7	2.7	2.7	*a* 2.3	3.7	4.3	4.5	3.4	3.5	3.45	3.4
9	2.8	2.7	2.7	2.65	*a* 2.3	3.6	4.3	4.45	3.4	.....	.....	.....
10	2.8	2.7	2.7	2.65	*a* 2.3	3.8	4.4	4.4	.....	.....	3.45	3.4
11	2.8	2.7	2.7	2.6	*a* 2.3	3.8	4.45	4.5	3.4	3.5	.....	.....
12	2.8	2.7	2.7	*a* 2.5	*a* 2.3	3.75	4.5	4.3	3.4	.....	3.45	3.4
13	2.8	2.7	2.7	*a* 2.35	3.2	3.8	4.6	4.4	3.4	3.5	.....	.....
14	2.8	2.7	2.7	2.2	3.4	3.7	4.6	4.4	.....	.....	3.5	3.4
15	2.8	2.7	2.65	2.2	3.4	3.8	4.5	4.1	3.5	3.5	.....	.....
16	2.8	2.7	2.65	2.1	3.3	3.85	4.6	4.0	3.6	.....	3.45	3.4
17	2.85	2.7	2.65	2.1	3.2	3.9	4.5	3.9	.....	3.6	.....	.....
18	2.85	2.75	2.65	2.5	3.1	3.8	4.4	3.8	3.5	.....	3.4	3.4
19	2.85	2.8	2.65	2.6	3.2	3.9	4.4	3.75	3.5	3.5	.....	.....
20	2.85	2.8	2.65	2.3	3.4	3.9	4.3	3.7	.....	.....	3.45	3.4
21	2.8	2.85	2.65	2.3	3.6	3.95	4.1	3.7	3.6	3.65	.....	.....
22	2.85	3.05	2.7	2.3	3.3	3.9	4.2	3.7	.....	.....	3.45	3.4
23	2.85	3.0	2.75	2.3	3.4	3.8	4.15	3.7	3.7	.....	.....	.....
24	2.9	3.0	2.75	2.5	3.3	3.9	4.0	3.65	3.7	.....	3.45	3.4
25	2.9	2.9	2.7	2.5	3.4	3.95	4.0	*a* 3.4	3.7	3.5	.....	.....
26	2.9	2.85	2.75	2.5	3.3	4.0	4.2	*a* 3.45	.....	.....	3.45	3.4
27	2.9	2.8	2.75	2.6	3.3	3.9	*a* 4.2	3.5	3.7	3.55	.....	.....
28	2.85	2.75	2.8	2.5	3.4	3.9	4.2	3.5	.....	.....	3.4	3.45
29	2.85	2.7	2.8	2.5	3.4	3.9	4.3	3.45	3.7	3.5	.....	.....
30	2.8	.....	2.8	2.5	3.3	3.9	4.3	*a* 3.4	.....	.....	3.4	3.4
31	2.8	.....	2.8	.....	3.4	.....	4.4	3.4	.....	3.5	.....	.....

a Estimated.

Monthly discharge of Pine Creek near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	12	9	10.4	640	C.
February	12	9	11.6	644	C.
March	27	8	13.4	824	C.
April	12	10	11.7	696	C.
May	105	9	28.3	1,740	C.
June	262	12	111	6,600	C.
July	230	159	193	11,900	C.
August	206	46	101	6,210	C.
September	46	19	30.8	1,830	C.
October	24	19	19.3	1,190	C.
November	19	11	15.3	910	C.
December	17	13	14.4	885	C.
The year	262	8	46.7	34,100	
1908.					
January	12	8.4	10.1	621	C.
February	20	5.8	8.2	472	C.
March	8.4	4.9	6.2	381	C.
April	8.4	1.0	3.6	214	C.
May	9	1.0	2.8	172	C.
June	31	4.0	17.5	1,040	C.
July	104	24	62.0	3,810	C.
August	90	4.0	42.0	2,580	C.
September	13	4.0	7.5	446	C.
October	13	6.0	7.7	474	C.
November	6	4.0	4.7	280	C.
December	5	4.0	4.0	246	C.
The year	104	1.0	14.7	10,700	

NOTE.—The daily discharges were obtained from several rating tables covering short periods of time.

BISHOP CREEK NEAR BISHOP, CAL.

This station was established August 10, 1903, at the wagon bridge on the Bishop road, about 4 miles southwest of Bishop and 2 miles below the mouth of Bishop Creek canyon. The North Hillside canal, South Hillside canal, and Powers canal are taken out above the station.

From May to August, 1907, the daily flow of the creek was obtained from readings on a 30-foot weir located about 3 miles above the mouth of the canyon and above all diversions. The filling of the basin above the weir during the high water of June, 1907, caused considerable velocity of approach, for which allowance was made in estimates from June 25 to July 31, 1907.

Discharge measurements of Bishop Creek and canals near Bishop, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			Creek.	Canals.	Total.
1907.		*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
January 25	G. R. Shuey	1.95	53	0	53
February 14	do	1.90	57	1.3	58
March 9	do	1.80	45	1.2	46
March 18	do	2.05	70	0	70
April 5	do	1.90	50	1.4	51
April 24	do	2.40	112	23	135
April 29	do	2.55	135	19	154
September 6	R. B. Post	2.30	89	16	105
September 22	do	2.10	56	16	72
October 4	do	1.87	43	28	71
October 28	do	1.90	44	11	55
November 16	do	1.95	49	6	55
December 9	do	1.58	37	10	47
1908.					
February 23	R. B. Post	2.00	73	0	73
March 26	do	2.10	70	10	80
May 13	do	2.10	72	12	84
June 19	do	2.30	97	9	106
July 15	Lamb and Post	2.95	184	36	220
August 3	W. A. Lamb	3.50	319	31	350
August 25	do	1.96	60	16	76
September 16	do	2.00	60	19	79
October 7	do	2.05	64	17	81
October 22	Lamb and Barrows	1.94	54	10	64
November 6	A. T. Barrows	2.09	72	3	75
November 25	Barrows and Lee	1.92	56	12	68

Daily gage height in feet, of Bishop Creek near Bishop, Cal., for 1907 and 1908.

[A. F. Kilpatrick and C. R. Beals, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.9	1.95	1.9	2.0	.....	.....	.....	.....	.....	1.85	1.8	1.75
2	1.85	2.0	2.0	2.0	.....	.....	.....	.....	.....	2.0	1.8	1.7
3	1.9	2.0	1.95	2.0	.....	.....	.....	.....	.....	1.95	1.8	1.7
4	1.9	1.95	1.95	2.0	.....	.....	.....	.....	.....	1.8	1.9	1.6
5	1.95	1.95	1.9	2.0	.....	.....	.....	.....	.....	2.0	1.8	1.75
6	1.9	1.9	1.95	1.9	.....	.....	.....	.....	2.3	2.0	1.8	1.7
7	1.95	2.0	1.85	2.0	.....	.....	.....	.....	.....	2.0	1.8	1.75
8	1.9	1.9	1.9	2.0	.....	.....	.....	.....	2.15	2.0	1.8	1.75
9	2.0	1.95	1.9	2.0	.....	.....	.....	.....	2.05	2.0	1.8	1.75
10	2.0	1.95	1.95	2.0	.....	.....	.....	.....	2.2	1.9	1.8	1.8
11	2.0	1.9	1.9	2.0	.....	.....	.....	.....	2.15	1.8	1.8	1.7
12	2.0	1.95	1.95	2.1	.....	.....	.....	.....	2.25	1.8	1.8	1.75
13	2.0	1.95	1.9	2.15	.....	.....	.....	.....	2.25	1.8	1.8	1.75
14	2.0	2.0	1.95	2.0	.....	.....	.....	.....	2.02	1.8	1.8	1.7
15	2.0	1.9	1.9	2.0	.....	.....	.....	.....	2.01	1.8	1.8	1.7
16	2.1	1.9	1.95	2.0	.....	.....	.....	.....	2.05	1.9	1.8	1.7
17	2.2	1.9	1.9	2.0	.....	.....	.....	.....	2.01	2.0	1.9	1.8
18	2.0	1.95	1.95	2.0	.....	.....	.....	.....	1.95	2.0	1.9	2.0
19	2.1	1.95	1.95	2.0	.....	.....	.....	.....	2.0	1.9	1.85	1.8
20	2.0	1.95	2.0	2.0	.....	.....	.....	.....	2.0	1.9	1.8	1.75
21	2.05	2.0	2.0	2.0	.....	.....	.....	.....	2.05	2.0	1.9	1.9
22	2.0	1.95	2.0	2.05	.....	.....	.....	.....	2.0	2.0	1.8	1.95
23	2.05	1.9	2.1	2.05	.....	.....	.....	.....	1.95	2.1	1.8	1.85
24	2.05	1.95	2.0	2.05	.....	.....	.....	.....	1.9	1.9	1.8	1.85
25	1.95	1.9	2.0	2.05	.....	.....	.....	.....	1.85	1.9	1.85	1.9
26	1.95	1.95	2.0	2.05	.....	.....	.....	.....	1.9	1.8	1.8	1.75
27	2.0	1.9	2.0	2.5	.....	.....	.....	.....	1.85	2.1	1.8	1.8
28	1.95	2.0	2.0	.....	.....	.....	.....	.....	1.8	2.0	1.8	1.85
29	1.95	.....	1.95	2.55	.....	.....	.....	.....	1.85	1.9	1.8	1.95
30	1.95	.....	2.0	.....	.....	.....	.....	.....	1.8	1.8	1.65	1.85
31	1.95	.....	2.0	.....	.....	.....	.....	.....	.....	1.8	.....	2.3
1908.												
1	2.1	2.0	1.95	2.0	2.2	2.3	2.8	2.7	2.25	2.05	1.95	1.8
2	2.15	1.95	1.95	2.0	2.4	2.25	2.5	3.5	2.2	2.0	1.95	1.85
3	2.3	2.0	1.85	1.95	2.5	2.15	2.55	3.6	2.0	2.05	1.95	1.8
4	2.1	2.0	2.1	1.9	2.3	1.9	2.6	3.7	2.15	2.0	1.85	1.75
5	1.95	1.9	1.9	1.95	2.4	1.9	2.8	3.7	2.1	2.05	1.95	1.8
6	1.95	1.9	1.95	2.1	2.3	1.95	2.8	3.5	2.1	2.0	2.0	1.7
7	1.85	1.9	2.2	2.0	2.2	2.1	3.1	2.9	2.1	2.1	1.95	1.9
8	1.8	1.8	2.4	1.9	2.3	2.0	3.1	2.9	2.3	1.95	1.9	1.85
9	1.9	2.0	2.3	1.9	2.35	2.1	3.1	2.9	2.3	2.1	1.9	1.8
10	1.7	1.9	2.1	2.0	2.1	2.1	2.85	3.1	2.2	1.95	2.0	1.8
11	1.95	1.9	2.0	1.95	2.0	2.2	2.9	2.8	2.3	1.8	1.95	1.8
12	1.9	1.85	2.3	1.9	2.0	2.2	3.0	2.8	2.1	1.9	1.95	1.8
13	1.95	1.8	2.1	1.95	2.0	2.4	3.1	2.2	2.2	1.9	1.9	1.7
14	1.85	1.9	2.0	1.9	2.1	2.4	3.1	2.1	1.9	2.0	1.95	1.85
15	2.0	2.3	2.0	1.95	2.0	2.4	2.95	2.2	2.3	2.0	1.85	1.75
16	1.7	1.85	2.0	1.9	1.9	2.2	2.3	2.3	2.0	1.9	1.9	1.7
17	1.85	1.8	2.0	2.0	1.9	2.3	2.4	2.2	2.1	2.0	1.9	1.8
18	1.85	1.85	1.9	1.85	2.1	2.15	2.3	2.3	2.15	2.0	1.95	1.85
19	1.85	2.0	1.85	1.95	2.0	2.25	2.5	2.3	2.2	1.95	1.9	1.8
20	1.85	2.0	1.95	2.1	2.0	2.2	2.5	2.1	2.1	2.0	1.95	1.8
21	1.75	2.1	1.9	2.1	2.1	2.25	2.5	2.1	2.1	1.9	1.8	1.8
22	1.9	2.0	2.0	2.0	2.15	2.3	2.5	2.2	1.95	1.9	1.8	1.8
23	1.8	2.0	1.95	2.0	1.9	2.5	2.8	2.2	2.15	2.0	2.2	1.75
24	1.85	1.9	1.95	1.9	2.1	2.4	2.7	2.3	2.25	1.95	1.95	1.85
25	2.0	2.2	2.0	1.95	2.0	2.6	2.6	2.0	2.2	1.9	1.9	1.7
26	1.85	1.95	2.0	1.85	2.1	2.5	2.5	2.3	2.0	2.0	1.8	1.8
27	1.9	1.85	2.1	1.9	2.15	2.8	2.5	2.2	2.0	2.0	1.8	1.9
28	2.15	1.9	1.9	1.85	2.1	2.7	2.8	2.2	2.0	1.95	1.7	1.95
29	1.95	1.8	1.9	2.1	2.3	2.7	2.7	2.0	2.0	2.0	1.8	1.85
30	2.0	.....	1.9	2.2	2.3	2.7	2.6	2.1	1.9	1.95	1.8	1.9
31	2.3	.....	2.0	.....	2.2	.....	2.7	2.1	.....	2.0	.....	1.7

NOTE.—No gage heights recorded from May 1 to September 5, 1907. Records of daily discharge were obtained from the weir.

Rating table for Bishop Creek near Bishop, Cal., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	40	2.20	81	2.80	163	3.40	288
1.70	44	2.30	92	2.90	180	3.50	314
1.80	49	2.40	104	3.00	198	3.60	341
1.90	55	2.50	117	3.10	218	3.70	370
2.00	62	2.60	131	3.20	240	3.80	400
2.10	71	2.70	146	3.30	263		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 12 discharge measurements made during 1908. It is fairly well defined between gage heights 1.9 feet and 3.5 feet.

Monthly discharge of Bishop Creek near Bishop, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	76	48	56.4	3,470	C.
February	58	49	54.0	3,000	C.
March	66	49	55.4	3,410	C.
April	148	58	75.8	4,510	C.
May	195	101	131	8,060	B.
June	442	226	297	17,700	D.
July	418	302	354	21,800	D.
August	300	190	231	14,200	B.
September	160	41	83.7	4,980	B.
October	58	41	66.0	4,060	B.
November	42	38	49.4	2 940	B.
December	88	38	52.5	3,230	B.
The year	442	38	126	91,400	
1908.					
January	92	44	58.8	3,620	B.
February	92	49	58.6	3,370	B.
March	104	52	64.3	3,950	B.
April	71	52	59.7	3,550	B.
May	117	55	76.6	4,710	B.
June	163	55	94.5	5,620	B.
July	218	92	150.0	9,220	B.
August	370	62	143.0	8,790	B.
September	92	55	73.7	4.390	B.
October	71	49	60.4	3,710	B.
November	81	44	55.7	3,310	B.
December	58	44	49.4	3,040	B.
The year	370	44	78.7	57,300	

NOTE.—The monthly discharge for 1907 includes diversions above the station during February to April and September to December, inclusive. From May to August, inclusive, the estimate is made from readings on a 30-foot weir located about 3 miles above the mouth of the canyon above all diversions. Discharges over weir from June 9–24 and for the month of August, 1907, were interpolated. The monthly discharge for 1908 does not include diversions above gaging station.

BAKER CREEK NEAR BIG PINE, CAL.

This station was established February 20, 1908, at a point about 150 feet below the bridge on Mill road and about 3 miles west of the town of Big Pine.

No gage height observations were made prior to 1909.

Discharge measurements of Baker Creek near Big Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	G. R. Shuey				16
May 2	do				28
May 25	do				41
June 10	do				37
July 6	do				24
December 9	R. B. Post				14
1908.					
February 20	R. B. Post	4.5	5.6	0.3	11
March 19	do	5	6.7	.41	14
May 14	do	5	7.3	.52	18
June 10	do	5	5.5	.00	10
July 17	W. A. Lamb	3.4	2.9	−.10	5.3
August 1	do	3.2	3.6	.00	8.6
August 13	do	.3	3.0	−.17	5.5
August 27	do	3.4	3.2	−.02	7.5
September 15	do	3.5	3.5	−.02	8.2
October 6	do	3	3.1	−.05	6.5
October 23	A. T. Barrows	3.5	4.3	.30	15
November 8	do	3.5	3.0	−.10	7.2
November 24	Barrows and Lee	4	4.5	−.05	8.1

BIG PINE CREEK NEAR BIG PINE, CAL.

This station was originally established December 5, 1903, at a point about 3 miles southwest of Big Pine where the creek issues from the foothills. It was established anew October 29, 1907, at a point about one-half mile east of the original station and about 2 miles southwest of Big Pine.

No record of gage heights was kept in 1907 or in the early part of 1908, but regular discharge measurements were made frequently.

Discharge measurements of Big Pine Creek near Big Pine, Cal., in 1907.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
		Sec.-ft.			*Sec.-ft.*
January 27	G. R. Shuey	18	July 6	G. R. Shuey	202
February 18	do	20	July 27	do	208
March 7	do	20	August 16	R. B. Post	120
March 28	do	21	August 26	do	98
April 8	do	23	September 8	do	55
April 21	do	51	September 24	do	31
May 2	do	47	October 29	do	30
May 17	do	54	November 15	do	24
June 11	do	83	December 9	do	20

Discharge measurements of Big Pine Creek and canals near Big Pine, Cal., in 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			Creek.	Canals.	Total.
		Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
February 19	R. B. Post	2.65	20	0	20
March 18	do	2.75	23	0	23
May 11	do	2.80	23	0	23
May 22	do	2.76	22	0	22
June 10	do	3.07	47	5	52
June 17	do	3.16	47	6	53
July 7	do	3.79	116	8	124
July 14	Post and Lamb	3.70	113	0	113
August 1	W. A. Lamb	4.10	166	14	180
August 13	do	3.72	112	3	115
August 27	do	3.33	67	8	75
September 15	do	3.05	46	2	48
October 6	do	2.70	21	1	22
October 24	Lamb and Barrows	2.51	13	0	13
November 8	A. T. Barrows	2.48	12	0	12
November 24	Barrows and Lee	2.48	12	0	12

Daily gage height, in feet, of Big Pine Creek near Big Pine, Cal., for 1908.

[Wesley Newman, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1								2.5
2		2.95			3.4	2.7	2.6	
3		2.90						2.5
4					3.4		2.6	
5		2.8	3.8			2.7		2.5
6				3.8			2.6	
7		2.85	3.8		3.3	2.7		
8				3.9				2.5
9		3.05	3.85		3.4	2.7	2.5	
10				4.0				2.5
11		3.15	3.8		3.5		2.5	
12				3.7		2.6		2.6
13		3.25	3.85				2.5	
14					3.1	2.6		
15			4.0					2.6
16					2.9	2.6	2.4	
17		2.65	3.85	3.5				2.6
18					2.9		2.4	
19		2.7	3.9	3.4		2.6		2.6
20							2.4	
21		2.8	3.85	3.4	2.9	2.6		
22	2.75							2.6
23		2.85			2.9	2.6		
24	2.85			3.3			2.5	2.6
25		3.05			2.9			
26	2.95			3.3		2.6	2.5	2.6
27		3.25						
28	2.95			3.2	2.9	2.6	2.5	
29		3.05						2.5
30	3.00	3.00			2.8	2.6		
31				3.3				2.5

Rating table for Big Pine Creek near Big Pine, Cal., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	10	2.90	32	3.40	74	3.90	137
2.50	13	3.00	39	3.50	85	4.00	151
2.60	17	3.10	47	3.60	97	4.10	166
2.70	21	3.20	55	3.70	110	4.20	181
2.80	26	3.30	64	3.80	123	4.30	196
						4.40	211

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during November, 1907, to December, 1908, and is well defined between gage heights 2.4 feet and 4.1 feet.

Monthly discharge of Big Pine Creek near Big Pine, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January			18	1,110	D.
February			20	1,110	D.
March			20	1,230	D.
April			38	2,260	D.
May			56	3,440	D.
June			110	6,540	D.
July			202	12,400	D.
August			118	7,260	D.
September			46	2,740	D.
October			30	1,840	D.
November			24	1,430	D.
December			20	1,230	D.
The year			58	42,600	
1908.					
January			20.0	1,230	D.
February			20.0	1,150	D.
March			23.0	1,410	D.
April			25.0	1,490	D.
May	39	23	28.0	1,720	C.
June	64	21	39.0	2,320	B.
July	166	55	131	8,060	B.
August	166	55	100	6,150	B.
September	85	26	50.0	2,980	B.
October	21	17	18.0	1,110	B.
November	17	10	13.0	774	B.
December	17	13	15.0	922	B.
The year			40.0	29,300	

NOTE.—Daily discharges for 1907 were interpolated between the discharge measurements. The monthly discharges for 1908 do not include diversion above the station. The monthly discharges for January to April, inclusive, are estimated.

BIRCH CREEK NEAR TINEMAHA, CAL.

This station, originally established June 14, 1905, was reestablished December 7, 1906, at a point near Peterson's ranch house, about 1 mile west of Fish Springs schoolhouse, and about 8 miles south of Big Pine.

Discharge measurements of Birch Creek near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	5.5	4.2	0.40	4.7
February 26	do	5	3.9	.40	5.9
March 29	do	5	4.2	.33	7.3
April 10	do	4.5	3.4	.40	5.4
April 15	do	4.5	3.8	.50	8.2
May 17	do	5	5.2	.57	13
June 12	do	5.5	6.4	.70	22
July 11	do	6	7.6	.85	29
August 15	R. B. Post	5.2	5.2	.69	18
August 27	do	4.5	4.6	.60	16
September 9	do	4.5	4.2	.40	10
September 30	do	4.5	3.4	.28	4.4
October 30	do	4	3.0	.27	4.4
November 12	do	4	3.2	.25	5.0
November 25	do	4	3.1	.25	4.8
1908.					
February 18	R. B. Post	4.5	3.1	.23	4.7
March 9	do	4.5	3.1	.25	4.4
March 25	do	4.5	3.2	.29	5.4
April 7	do	4.5	3.1	.28	4.8
May 2	do	5	3.7	.35	8.0
May 21	do	4.5	3.3	.28	4.8
June 10	do	5	3.9	.34	7.5
June 29	do	5	4.6	.53	13
July 7	do	5	4.7	.60	15
July 14	Post and Lamb	5	5.4	.60	16
July 31	W. A. Lamb	5	5.6	.60	18
August 12	do	5	5.2	.60	15
August 25	do	5	2.8	.....	6.8
September 14	do	5	4.2	.35	6.2
September 18	do	6	3.3	.....	7.1
October 5	do	5	3.7	.25	5.1
October 7	do	3	1.5	.....	5.1
October 21	Barrows and Lamb	5	3.3	.19	2.9
November 9	A. T. Barrows	5	3.4	.20	3.1
November 24	do	5	3.2	.21	2.9

Daily gage height, in feet, of Birch Creek near Tinemaha, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5	0.4	0.35	0.35	0.55	0.8	0.8	0.9	0.4	0.25	0.25	0.2
2	.8	.4	.35	.35	.55	.8	.8	.95	.4	.25	.25	.25
3	.75	.4	.35	.35	.55	.8	1.0	.9	.4	.25	.3	.25
4	.4	.4	.45	.35	.55	.8	1.1	.8	.4	.25	.25	.2
5	.35	.4	.5	.35	.55	.8	1.0	.75	.4	.3	.25	.2
6	.35	.4	.4	.35	.5	.8	1.0	.75	.4	.3	.25	.3
7	.35	.4	.4	.4	.5	.75	.9	.75	.35	.3	.25	.3
8	.35	.45	.4	.4	.5	.7	.9	.75	.35	.3	.25	.3
9	.35	.4	.4	.4	.55	.6	.85	.75	.35	.25	.25	.3
10	.4	.4	.4	.4	.55	.7	.9	.7	.35	.25	.25	.3
11	.4	.4	.45	.45	.55	.7	.9	.7	.35	.25	.25	.25
12	.4	.4	.45	.5	.5	.6	.9	.65	.4	.25	.25	.25
13	.45	.4	.45	.5	.5	.55	.9	.6	.4	.25	.25	.25
14	.4	.4	.4	.5	.55	.6	.9	.7	.35	.25	.25	.25
15	.4	.4	.4	.45	.55	.55	.9	.7	.3	.3	.25	.25

Daily gage height, in feet, of Birch Creek near Tinemaha, Cal., for 1907 and 1908. Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	0.45	0.4	0.4	0.45	0.6	0.55	0.85	0.7	0.3	0.4	0.25	0.25
17	.4	.4	.5	.45	.6	.55	.85	.7	.3	.4	.25	.25
18	.45	.4	.45	.5	.6	.55	.85	.8	.3	.35	.25	.2
19	.45	.4	.55	.5	.65	.6	.85	.8	.3	.3	.25	.2
20	.45	.4	.5	.5	.65	.7	.85	.7	.3	.3	.25	.2
21	.4	.5	.5	.5	.65	.7	.8	.7	.25	.3	.25	.25
22	.4	.4	.5	.5	.6	.6	.8	.7	.25	.35	.25	.25
23	.4	.4	.45	.5	.6	.6	.8	.6	.25	.4	.25	.2
24	.4	.4	.45	.55	.55	.6	.9	.6	.25	.3	.25	.25
25	.4	.4	.45	.55	.55	.6	.9	.6	.25	.3	.2	.2
26	.4	.4	.45	.55	.55	.7	.9	.55	.25	.3	.2	.25
27	.4	.4	.45	.5	.55	.8	.85	.5	.25	.25	.2	.25
28	.4	.4	.35	.55	.6	.9	.8	.5	.25	.25	.2	.25
29	.45	.....	.35	.55	.6	1.0	.8	.45	.25	.25	.2	.25
30	.45	.....	.3	.55	.7	.9	.8	.4	.25	.25	.2	.25
31	.4	.....	.3	.....	.7	.....	.8	.4	.....	.25	.....	.25
1908.												
1	.25	.25	.3	.25	.4	.3	.55	.5	.35	.2	.2	.2
2	.25	.25	.35	.25	.35	.3	.6	.55	.35	.2	.2	.2
3	.25	.3	.3	.25	.35	.3	.6	.6	.4	.2	.2	.2
4	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
5	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
6	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
7	.25	.3	.3	.25	.3	.3	.6	.6	.4	.3	.2	.2
8	.25	.25	.25	.3	.3	.3	.6	.6	.4	.3	.2	.2
9	.25	.25	.25	.3	.3	.3	.6	.6	.4	.2	.2	.2
10	.25	.25	.25	.3	.3	.35	.6	.6	.4	.2	.2	.2
11	.25	.25	.25	.25	.25	.4	.6	.6	.4	.2	.2	.2
12	.25	.25	.25	.25	.25	.45	.6	.6	.3	.2	.2	.2
13	.25	.35	.25	.3	.25	.55	.6	.55	.3	.15	.2	.2
14	.25	.3	.3	.3	.25	.55	.55	.5	.3	.2	.2	.2
15	.25	.3	.3	.3	.25	.45	.55	.5	.3	.3	.2	.2
16	.25	.3	.3	.3	.25	.45	.5	.45	.3	.3	.2	.2
17	.25	.25	.3	.3	.25	.45	.5	.45	.3	.3	.2	.2
18	.25	.25	.3	.3	.25	.4	.5	.45	.3	.3	.2	.2
19	.25	.25	.3	.35	.25	.4	.5	.45	.3	.3	.2	.2
20	.25	.25	.3	.3	.25	.4	.5	.45	.25	.3	.2	.2
21	.25	.25	.3	.3	.25	.45	.5	.4	.25	.3	.2	.2
22	.25	.25	.3	.3	.25	.4	.5	.4	.25	.25	.2	.2
23	.3	.25	.3	.3	.25	.5	.5	.4	.25	.25	.2	.2
24	.3	.25	.3	.3	.25	.5	.6	.4	.25	.25	.2	.2
25	.35	.25	.3	.25	.25	.55	.6	.4	.25	.25	.2	.2
26	.35	.3	.3	.3	.3	.55	.5	.35	.3	.25	.2	.2
27	.3	.3	.25	.35	.3	.55	.6	.35	.3	.2	.2	.2
28	.3	.3	.25	.35	.35	.55	.6	.3	.3	.2	.2	.2
29	.3	.3	.25	.35	.35	.55	.6	.3	.3	.2	.2	.2
30	.3	.....	.25	.3	.4	.55	.5	.3	.3	.2	.2	.2
31	.3	.....	.25	.....	.35	.....	.5	.35	.....	.2	.....	.2

Monthly discharge of Birch Creek near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	26	5.2	7.6	467	C.
February	8.9	6	6.2	344	C.
March	11	4.6	8.2	504	C.
April	11	5.2	8.0	476	C.
May	20	8.9	12.5	769	C.
June	42	11	20.0	1,190	C.
July	50	26	32.0	1,970	C.
August	38	6	19.3	1,190	C.
September	6	4.3	5.0	298	C.
October	6	4.3	4.6	283	C.
November	4.6	4.2	4.3	256	C.
December	4.6	4.2	4.3	264	C.
The year	50	4.2	11.4	8,010	

Monthly discharge of Birch Creek near Tinemaha, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	7.1	4.8	5.2	320	C.
February	5.8	4.8	5.2	299	C.
March	7.1	3.9	5.5	338	C.
April	7.1	4.8	5.6	333	C.
May	8.4	4.8	5.7	350	C.
June	14	5.8	9.6	571	C.
July	16	12	14.3	879	C.
August	21	5.8	11.9	732	C.
September	8.4	4.8	6.5	387	C.
October	5.6	3.0	4.1	252	C.
November	3.0	3.0	3.0	179	C.
December	3.0	3.0	3.0	184	C.
The year	21	3.0	6.6	4,820	

NOTE.—The daily discharge was obtained from several rating tables covering short periods of time.

TINEMAHA CREEK NEAR TINEMAHA, CAL.

This station was established December 7, 1906, at a point near Peterson's ranch house, about 1 mile west of Fish Springs schoolhouse, and 8 miles south of Big Pine.

Discharge measurements of Tinemaha Creek near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	6	3.4	0.50	4.7
February 26	do	6	3.0	.43	3.4
March 29	do	6	3.2	.45	4
April 10	do	7	3.4	.45	4.2
April 15	do	7	4.8	.60	7.6
May 6	do	7.4	5.5	.63	9.4
May 17	do	7	4.8	.60	7.9
June 12	do	8	7.4	.85	19
July 11	do	9	12	1.40	40
August 15	R. B. Post	8	8.8	1.05	29
August 27	do	9	7	.80	20
September 9	do	6	4	.40	6.4
September 30	do	7	4.4	.38	6.5
October 30	do	7	4.6	.45	7.6
November 12	do	7	4.1	.38	6.4
November 25	do	6	2.9	.32	4.9
1908.					
February 18	R. B. Post	7.5	4.4	.61	6.3
March 9	do	7	3.0	.52	3.3
March 25	do	7	3.3	.52	4
April 7	do	7	3.4	.53	4.1
May 2	do	7	3.9	.59	6
May 21	do	6.5	3.3	.51	4.2
June 10	do	7	4.0	.55	6.0
June 29	do	7.5	7.8	.93	20
July 7	do	7.5	9.0	1.09	27
July 14	Post and Lamb	8.2	9.3	1.10	29
July 31	W. A. Lamb	8.5	8.4	1.02	24
August 12	do	8	7.5	.91	20
August 24	do	8	5.6	.76	12
September 14	do	8	6.3	.80	14
October 5	do	7	4.0	.60	6.2
October 21	Barrows and Lamb	8	3.9	.54	5
November 8	A. T. Barrows	7.5	4.0	.55	4.9
November 24	do	7.5	4.0	.51	5.1

Daily gage height, in feet, of Tinemaha Creek near Tinemaha, Cal., for 1907 and 1908.

[Enid M. Peterson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.4	0.5	0.4	0.35	0.65	0.8	1.15	1.1	0.5	0.35	0.35	0.35
2	.4	.5	.3	.35	.65	.85	1.3	1.2	.5	.35	.35	.35
3	.5	.5	.4	.35	.65	.85	1.6	1.2	.5	.35	.35	.35
4	.45	.5	.6	.35	.7	.9	1.9	1.1	.5	.35	.35	.35
5	.5	.45	.5	.35	.5	.95	1.8	1.1	.5	.3	.35	.35
6	.5	.5	.45	.35	.6	.85	1.6	1.1	.4	.3	.35	.35
7	.5	.45	.45	.35	.6	.9	1.6	1.0	.4	.3	.35	.35
8	.5	.45	.45	.35	.6	.85	1.5	1.0	.4	.3	.35	.35
9	.5	.5	.4	.35	.6	.8	1.5	1.0	.4	.3	.35	.35
10	.5	.5	.4	.35	.6	.8	1.4	.9	.4	.3	.35	.45
11	.5	.5	.4	.4	.6	.8	1.3	.9	.4	.3	.35	.35
12	.45	.5	.45	.4	.6	.8	1.3	.8	.4	.3	.35	.35
13	.5	.5	.5	.4	.6	.8	1.3	.8	.45	.3	.35	.4
14	.5	.45	.45	.5	.65	.8	1.4	.8	.45	.3	.35	.4
15	.5	.45	.4	.5	.65	.75	1.3	.8	.3	.3	.35	.35
16	.5	.4	.4	.5	.6	.75	1.2	.85	.4	.4	.35	.35
17	.5	.45	.5	.55	.6	.7	1.1	.9	.4	.4	.35	.35
18	.5	.45	.45	.55	.6	.7	1.2	1.0	.4	.4	.35	.35
19	.5	.45	.55	.55	.65	.7	1.2	1.0	.4	.35	.35	.35
20	.5	.45	.5	.55	.6	.75	1.2	.9	.4	.35	.35	.35
21	.5	.5	.5	.55	.65	.8	1.2	.8	.4	.35	.35	.35
22	.5	.5	.45	.6	.8	.8	1.2	.8	.4	.35	.35	.3
23	.45	.5	.5	.6	.75	.8	1.2	.75	.4	.4	.35	.35
24	.5	.45	.45	.6	.8	.8	1.2	.7	.4	.4	.35	.35
25	.5	.45	.45	.6	.75	.85	1.3	.7	.4	.4	.35	.3
26	.5	.45	.45	.6	.8	.9	1.3	.65	.35	.4	.35	.35
27	.5	.45	.45	.6	.75	1.1	1.3	.6	.35	.4	.35	.4
28	.6	.45	.45	.65	.8	1.1	1.25	.6	.35	.35	.35	.4
29	.55	.....	.4	.65	.8	1.15	1.2	.6	.35	.35	.35	.4
30	.5	.....	.4	.65	.8	1.15	1.2	.55	.35	.35	.35	.4
31	.5	.....	.4	.....	.8	.....	1.2	.5	.....	.35	.....	.4
1908.												
1	.4	.4	.55	.55	.55	.55	.95	1.2	.6	.65	.55	.5
2	.3	.4	.55	.55	.6	.45	.95	1.15	.65	.6	.55	.45
3	.3	.35	.55	.55	.55	.45	.95	1.5	.7	.65	.55	.45
4	.35	.35	.5	.55	.55	.55	1.0	1.1	.75	.6	.5	.5
5	.35	.4	.5	.55	.55	.55	1.0	1.15	.75	.6	.5	.5
6	.35	.4	.5	.55	.6	.55	1.0	1.1	.7	.6	.5	.5
7	.35	.35	.5	.55	.55	.55	1.1	1.2	.8	.6	.5	.5
8	.35	.35	.5	.5	.55	.55	1.1	1.15	.8	.6	.5	.5
9	.35	.35	.55	.55	.55	.55	1.1	1.2	.8	.55	.5	.5
10	.35	.35	.5	.55	.6	.5	1.55	1.1	.8	.5	.5	.5
11	.35	.35	.5	.5	.55	.5	1.2	1.0	.75	.5	.5	.5
12	.35	.35	.5	.5	.55	.5	1.2	1.5	.75	.5	.5	.5
13	.35	.35	.5	.5	.55	.5	1.2	.95	.8	.55	.5	.5
14	.35	.35	.5	.55	.45	.55	1.3	.9	.75	.5	.5	.5
15	.35	.35	.55	.55	.45	.55	1.35	.9	.7	.5	.5	.5
16	.35	.35	.55	.5	.55	.55	1.3	.85	.65	.6	.5	.55
17	.35	.35	.5	.5	.45	.6	1.35	.8	.65	.5	.5	.55
18	.35	[a] .6	.55	.5	.45	.6	1.4	.8	.7	.5	.5	.55
19	.4	.6	.55	.5	.45	.65	1.4	.8	.75	.45	.45	.55
20	.4	.6	.55	.5	.55	.7	1.0	.8	.6	.45	.45	.55
21	.35	.6	.55	.5	.55	.7	1.1	.8	.7	.5	.45	.6
22	.4	.6	.55	.55	.45	.75	1.15	.85	.75	.5	.45	.6
23	.4	.6	.55	.5	.45	.75	1.1	.85	.7	.55	.5	.6
24	.4	.6	.55	.5	.55	.8	1.1	.8	.65	.55	.5	.6
25	.4	.6	.55	.55	.55	.8	1.15	.75	.65	.55	.5	.6
26	.5	.6	.55	.5	.55	.85	1.1	.75	.65	.55	.5	.6
27	.45	.6	.55	.55	.55	.85	1.1	.7	.6	.55	.5	.6
28	.45	.55	.55	.55	.45	.9	1.2	.7	.65	.55	.5	.55
29	.4	.55	.55	.55	.55	1.0	1.5	.65	.7	.55	.5	.55
30	.4	.....	.55	.55	.55	.95	1.1	.6	.7	.55	.5	.55
31	.4	.....	.55	.....	.55	.....	1.0	.6	.....	.55	.5	.5

[a] Gage changed.

Monthly discharge of Tinemaha Creek near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	8	3	4.9	301	C.
February	5	4	4.4	244	C.
March	8	2	4.0	246	C.
April	10	2.5	5.3	315	C.
May	16	5	11.0	676	C.
June	30	12	18.0	1,070	C.
July	66	29	39.0	2,400	C.
August	33	9	20.0	1,230	C.
September	7.8	5	6.1	363	C.
October	6.5	4.5	5.4	332	C.
November	5.5	5.5	5.5	327	C.
December	7.8	4.5	5.7	350	C.
The year	66	2	10.8	7,850	
1908.					
January	9.0	4.5	6.0	369	C.
February	6.5	4.8	5.8	334	C.
March	4.8	3.6	4.4	270	C.
April	4.8	3.6	4.3	256	C.
May	6.1	2.8	4.4	270	C.
June	24	2.8	8.5	506	C.
July	52	22	32	1,970	C.
August	49	6.1	21	1,290	C.
September	14	6.1	9.8	583	C.
October	7.5	5	5.5	338	C.
November	5.5	4.5	5.0	298	C.
December	6	4.5	5.3	326	C.
The year	52	3.6	9.3	6,810	

NOTE.—The daily discharges for 1907 were obtained from several rating tables covering short periods of time. The daily discharges for 1908 were obtained by the indirect method for shifting channels.

TABOOSE CREEK NEAR TIBBETTS, CAL.

The original station was not regularly established until August 20, 1906, though discharge measurements had been made from the first of the year. It was located about 15 miles north of Independence, 2 miles northwest of Tibbetts railway station, and about one-half mile west of the crossing on the lower main highway. On February 25, 1907, the station was transferred from the lower road crossing to a point on the upper road crossing, 2 miles farther upstream and about 4 miles northwest of Tibbetts.

Discharge measurements of Taboose Creek near Tibbetts, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 4	G. R. Shuey	4	1.2	1.50	1.3
February 25	do	6	2.1	.20	2.1
March 29	do	6	3.5	.20	3.2
April 10	do	5	2.8	.20	4.8
April 15	do	6	4.6	.25	8.1
May 6	do	6	4.6	.24	7.0
June 13	do	7	6.0	.60	12
June 29	do	7	7.0	.65	19
July 11	do	6	9	.60	22
August 2	Shuey and Post	7	11	.60	26
August 11	R. B. Post	6	5	.48	11
August 27	do	6	4.4	.25	7.8
September 9	do	6	4.7	.15	7
September 30	do	6	3.4	.05	3.4
October 21	do	6	3.5	.08	3.7
November 5	do	5	4.1	.05	4.2
November 29	do	5.5	4.0	.00	3.3
December 12	do	5.5	3.8	.50	3.3
1908.					
February 15	R. B. Post	6	3.5	.43	2.4
March 10	do	6	3.2	.42	2.2
March 21	do	6	3.2	.43	2.4
April 9	do	4	2.3	.17	2.3
April 29	do	5	3.7	.22	3.7
May 2	do	7	4.5	.27	5.9
May 21	do	5	2.6	.20	3.1
June 17	do	6	4.4	.47	6.9
June 26	do	6	4.6	.48	7.0
July 8	do	7	6.1	.63	12
July 14	Lamb and Post	8	7.3	.63	12
July 31	W. A. Lamb	7	6.2	.59	11
August 12	do	7	5.3	.50	9.7
August 24	do	6	4.4	.40	5.2
September 4	do	6.5	4.2	.36	4.3
September 14	do	6	4.1	.39	5.2
October 5	do	6	3.8	.30	4.3
October 21	Barrows and Lamb	6	3.8	.31	4.5
November 9	A. T. Barrows	6	3.8	.28	3.8

Daily gage height, in feet, of Taboose Creek near Tibbetts, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.6		0.2	0.2	0.8		0.7				0.1	
2		1.6						0.6	0.2			0.05
3	1.6			.2		1.0	.8					
4			.2		.8					0.1	.05	
5	1.6	1.55		.2		1.1	.9					
6			.2		.75			.55	.15			.05
7		1.55				1.0				.1		
8	1.6		.2	.2	.7						.05	
9		1.55				.9	.7	.5	.15			.05
10	1.6			.2	.75							
11			.2			.75	.6			.1	.05	
12	1.6	1.55		.25				.4				
13			.2		.75	.6	.6		.2			.5
14		1.5								.05		
15	1.6		.2	.25	.8		.6				.05	
16		1.5						.4	.15			.5
17	1.6			.25	.8	.55	.6					
18		1.5	.5							.05	.05	
19	1.6			.25		.5	.6	.4				
20		1.5	.35		.8				.1			.5
21						.5				.1		
22	1.6	1.5	.3	.75	.8		.45				.05	
23								.4	.1			.5
24	1.6			.8	.75	.55	.5					
25		.2	.25							.1	.05	

Daily gage height, in feet, of Taboose Creek near Tibbetts, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	1.6			0.8		0.6	0.55	0.35				
27		0.2	0.2		0.8				0.1			0.5
28						.65				0.1		
29	1.6		.2	.8	.85		.5	.3			0.05	
30									.1			.5
31	1.6				.9		.5					
1908.												
1					.3	.4						
2			.45							.35	.3	
3	.5	.45		.45			.5	.6				
4					.3				.4			.3
5						.3				.35		
6	.5		.45	.45			.6				.3	
7		.45						.6	.45			.35
8					.3	.4						
9			.45							.3	.3	
10	.5	.45		.2			.6	.6				
11					.25				.5			.4
12						.5				.3		
13	.5		.45	.2			.7				.3	
14		.45						.5	.5			.55
15					.25	.45						
16			.45							.3	.3	
17	.5	.45		.2			.6	.45				
18					.2				.45			.6
19						.5				.3		
20	.5		.45	.2			.55				.3	
21		.45						.4	.35			.3
22					.2	.45						
23			.45							.3	.3	
24	.5	.45		.2			.6	.45				
25					.3				.4			.3
26						.5				.3		
27	.5		.45	.25			.6				.3	
28		.45						.45	.4			.3
29					.4	.5						
30			.45							.3	.3	
31	.45							.4				

NOTE.—Beginning February 25, 1907, the gage heights refer to the gage at the new station 2 miles upstream and are not comparable with the old gage heights.

Monthly discharge of Taboose Creek near Tibbetts, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	2.3	2.3	2.3	141
February	6.2	1.4	2.3	128
March	14	6.2	7.3	449
April	24	6.2	12.0	714
May	28	20	23.0	1,410
June	36	14	21.0	1,250
July	28	12	18.0	1,110
August	18	8.5	12.0	738
September	6.2	4.3	5.0	298
October	4.3	3.6	4.2	258
November	4.3	3.6	3.6	214
December	3.6	2.9	3.2	197
The year	36	1.4	9.5	6,910

Monthly discharge of Taboose Creek near Tibbetts, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1908.				
January	3.0	2.4	3.0	184
February	2.4	2.3	2.3	132
March	2.3	2.2	2.3	141
April	5.2	2.5	3.1	184
May	7.2	3.1	4.9	301
June	8.0	4.5	6.0	357
July	14	8.0	10.9	670
August	11	5.7	8.2	504
September	8	5.0	6.4	381
October	5	4.0	4.5	277
November	4	4.0	4.0	238
December	10	4.0	5.5	338
The year	14	2.2	5.1	3,710

NOTE.—The daily discharges were obtained by the indirect method for shifting channels, and are approximate.

GOODALE CREEK NEAR TIBBETTS, CAL.

This station was established September 20, 1906, at the point where the stream leaves the foothills, about 13 miles north of Independence, 4 miles west of Tibbetts railway station, and one-fourth mile west of the upper road crossing.

Discharge measurements of Goodale Creek near Tibbetts, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	5	2.5	0.45	3.7
February 25	do	4.7	2.8	.43	3.9
March 29	do	4	2.4	.40	3.0
April 15	do	5	3.3	.60	6.6
May 6	do	5.5	3.6	.63	5.8
June 13	do	6	4.2	.75	9.7
June 28	do	6	5.2	.90	12
July 11	do	6	6.7	1.10	18
August 2	Shuey and Post	6	6.0	1.05	15
August 11	R. B. Post	5	3.8	.80	8.9
August 27	do	5	3.1	.65	6.7
September 9	do	5	2.8	.50	4.8
September 30	do	5	2.1	.45	3.1
October 21	do	5	2.1	.45	3.2
November 5	do	5	2.2	.41	3.4
November 29	do	5	2.1	.40	2.6
December 12	do	5	2.2	.39	2.8
1908.					
February 15	R. B. Post	5	2.6	.30	2.3
March 10	do	5	2.5	.32	2.2
March 21	do	5	2.6	.34	2.2
April 9	do	5	2.5	.30	2.3
April 29	do	5	3.0	.42	4.1
May 2	do	5	3.2	.33	4.2
May 21	do	5	2.5	.23	2.5
June 17	do	5	3.2	.35	4.4
June 26	do	5	3.4	.36	4.8
July 8	do	5	4.2	.50	7.4
July 14	Post and Lamb	5.7	4.7	.50	8.1
August 12	W. A. Lamb	5	4.0	.34	5.0
August 24	do	3.5	2.3	.26	4.0
September 4	do	5	2.3	.16	2.5
September 14	do	5	2.7	.22	3.7
October 5	do	5.3	2.6	.20	3.3
October 21	Barrows and Lamb	5	2.7	.17	3.4
November 9	do	5	2.6	.15	2.9

Daily gage height, in feet, of Goodale Creek near Tibbetts, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5		0.45	0.4	0.7		0.9				0.4	
2		0.45						1.05	0.5			0.4
3	.5			.4		0.9	.95					
4			.45		.7					0.4	.4	
5	.5	.45		.4		.95	.95					
6			.45		.65			.95	.5			.4
7		.45				.9				.4		
8	.5		.45	.45	.6						.4	
9		.45					1.0	.95	.5			.4
10	.5			.5	.65	.8						
11			.4				1.1			.4	.4	
12	.5	.45		.55		.75		.8				
13			.4		.65		1.05		.5			.4
14		.5				.7				.4		
15	.5		.4	.6	.7		1.1				.4	
16		.5						.85	.5			.4
17	.5			.6	.7	.75	1.1					
18		.5	.6							.4	.4	
19	.5			.6		.8	1.1	.8				
20		.5	.5		.7				.5			.4
21						.8				.4		
22	.5	.5	.45	.65	.7		1.0				.4	
23								.75	.5			.4
24	.5			.7	.65	.85	.9					
25		.45	.4							.4	.4	
26	.5			.7		.85	.95	.7				
27		.45	.35		.7				.45			.4
28						.9				.4		
29	.45		.4	.7	.75		.95	.65			.4	
30									.45			.4
31	.45				.8		.95					
1908.												
1					.45	.35						
2			.35							.25	.15	
3	.4	.35		.35			.45	.4				
4					.3				.2			.2
5						.3				.2		
6	.4		.35	.35			.5				.15	
7		.35						.5	.2			.2
8					.3	.35						
9			.35							.25	.15	
10	.4	.35		.35			.5	.4				
11					.3				.3			.25
12						.4				.25		
13	.4		.35	.35			.5				.18	
14		.35						.3	.3			.3
15					.3	.4						
16			.35							.2	.18	
17	.4	.35		.35			.45	.25				
18					.25				.3			.3
19						.35				.18		
20	.4		.35	.4			.4				.15	
21		.35						.25	.25			.2
22					.3	.3						
23			.35							.2	.2	
24	.4	.35		.4			.4	.25				
25					.3				.3			.18
26						.4				.15		
27	.4		.35	.4			.4				.2	
28		.35						.2	.3			.18
29					.3	.45						
30			.35							.15	.2	
31	.35						.4	.2				

Monthly discharge of Goodale Creek near Tibbetts, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	4.0	3.4	3.9	240	D.
February	4.0	3.3	3.6	200	D.
March	5.4	3.4	3.3	203	D.
April	7.2	2.8	5.1	304	C.
May	9.2	5.4	7.0	430	C.
June	14	7.2	10.2	607	C.
July	18	12	15.1	928	C.
August	16	5.5	10.3	633	C.
September	4.0	3.4	3.9	232	C.
October	2.8	2.8	2.8	172	D.
November	2.8	2.8	2.8	167	D.
December	2.8	2.8	2.8	172	D.
The year	18	2.8	5.9	4,290	
1908.					
January	3.0	2.6	3.0	184	D.
February	2.6	2.2	2.6	150	D.
March	2.6	2.2	2.6	160	D.
April	3.0	2.2	2.7	161	D.
May	4.7	3.6	4.4	270	D.
June	7.4	4.7	5.8	345	D.
July	8.3	6.4	7.3	449	D.
August	8.3	3.2	5.0	307	D.
September	4.7	3.2	4.1	244	D.
October	3.4	3.3	3.3	203	D.
November	3.0	3.0	3.0	179	D.
December	3.0	3.0	3.0	184	D.
The year	8.3	2.2	3.9	2,840	

NOTE.—The daily discharges were obtained by the indirect method for shifting channels.

DIVISION CREEK NEAR INDEPENDENCE, CAL.

The original station was established January 10, 1906, at a point on the upper road crossing, about 1½ miles west of the Ricky ranch house and about 10 miles north of Independence.

A new station was established May 9, 1908, at a point about 200 feet above the intake of the power canal of the Los Angeles aqueduct. On July 29, 1908, a cloudburst made the creek overflow its banks and materially changed the cross section at the gaging station.

Discharge measurements of Division Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	6	4.0	.....	10
February 25	do	6	3.6	2.40	8.9
March 29	do	6.5	4.3	2.40	9
April 15	do	6.5	3.9	2.40	10
May 5	do	6.5	3.6	2.30	9
June 13	do	6	4.4	2.40	12
June 28	do	6	3.8	2.30	10
July 7	do	6	4.8	2.40	13
August 2	Shuey and Post	6	4.6	2.30	12
August 11	R. B. Post	6.5	4.6	2.26	9.4
August 27	do	6.5	4.4	2.30	10
September 9	do	6.5	4.6	2.30	9.8
September 25	do	6.5	4.4	2.29	8.8
October 9	do	6.5	4.6	2.26	9.5
November 5	do	6.5	4.3	2.21	10
November 29	do	6.5	4.4	2.20	8.5
December 12	do	6	3.7	2.39	7.6

Discharge measurements of Division Creek near Independence, Cal., in 1907 and 1908—Con.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 5	R. B. Post	5	3.9	1.01	7.2
March 13	do	5	3	.91	5.9
April 3	do	5	3	.90	5.5
April 13	do	5	3	.90	5.7
April 20	do	5	3	.88	5.7
May 6	do	6	5.1	.65	7.2
June 17	do	5	5.6	.70	7.3
July 14	Post and Lamb	5	5.2	.67	6.4
July 31	W. A. Lamb	5	2	.93	9.8
August 12	do	5.2	2.9	.86	7.7
August 24	do	5	2.9	.76	7.7
October 5	do	5	3.7	.68	7.3
October 20	Lamb and Barrows	5	4.5	.80	7.5
November 5	A. T. Barrows		4.3	.82	8.0

Daily gage height, in feet, of Division Creek near Independence, Cal., for 1908.

[G. G. Noble, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.85	0.7				0.7	0.85	
2					.85		0.65				.85	
3					.85	.7		0.75	0.75		.85	
4					.85		.7	.9		.7	.85	0.8
5		1.0			.85	.7		.75			.85	
6					.85			.75	.75	.7	.85	.8
7		1.0				.7	.7	.75			.85	
8								.75	.75	.7	.85	
9					.7	.7					.85	
10		1.0			.7		.7	.75		.7	.85	.85
11		1.0				.7		.75	.85	.7	.85	
12					.7		.7	.75		.7	.85	
13						.7	.7	.75	.75	.7	.85	.8
14		1.0			.7			.75		.7	.85	
15						.7		.75	.75	.7	.85	
16		1.0			.7	.7	.7		.75	.7	.85	.8
17		1.0						.75		.7	.85	.8
18					.7		.7			.7	.85	
19		.95		0.85	.7	.7		.75		.75	.85	
20				.85	.7		.7			.8	.85	.8
21		1.0		.85	.7	.7		.75	.75	.8	.85	.8
22				.85		.7	.65			.8	.85	
23				.85	.7					.8	.8	
24				.85		.7	.7	.75	.8	.8	.8	
25				.85	.7					.85		.8
26		1.0		.85		.7		.75	.75	.85		
27				.85	.7		.7			.85		
28				.85	.7			.75	.75	.85		.8
29				.85		.7	[a].45			.85		
30				.85	.7	.65	.95	.75	.75	.85		.8
31					.7					.85		

[a] Channel changed during cloud-burst July 29.

Monthly discharge of Division Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January			10.6	652	D.
February			10.8	600	D.
March			11.2	689	D.
April			10.1	601	D.
May			9.7	596	D.
June			11.1	660	D.
July			12.4	762	D.
August			10.1	621	D.
September			9.9	589	D.
October			10.0	615	D.
November			9.0	536	D.
December			7.7	474	D.
The year			10.2	7,400	
1908.					
January			[a] 7.0	430	D.
February	7.2	6.0	6.7	385	C.
March	5.9	5.9	5.9	363	C.
April	5.9	5.7	5.8	345	C.
May	7.2	5.7	7.0	430	C.
June	7.3	6.4	7.2	428	C.
July	10.0	6.4	7.2	443	C.
August	8.0	7.7	7.7	473	C.
September	7.7	7.5	7.7	458	C.
October	8.0	7.3	7.5	461	C.
November	8.0	7.5	7.7	458	C.
December	8.0	7.5	7.6	467	C.
The year	10.0	5.7	7.1	5,140	

[a] Estimated.

NOTE.—The daily discharges for 1907 were obtained by interpolation between measurements, those for 1908 by the indirect method for shifting channels.

SAWMILL CREEK NEAR INDEPENDENCE, CAL.[a]

This station was established September 20, 1906, at a point on the upper road crossing about 300 feet beyond the Eightmile ranch and about 8 miles north of Independence. The gage was destroyed in the early part of 1907, and was not replaced.

[a] This stream was called Eightmile Creek in the 1906 report.

The following discharge measurements were made during 1907 and 1908:

Discharge measurements of Sawmill (Eightmile) Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	1908.		*Sec.-ft.*
April 10	G. R. Shuey	3.9	April 3	R. B. Post	4.6
May 5	do	6.0	May 1	do	3.9
June 13	do	12	June 17	do	3.1
August 27	R. B. Post	6.6	June 26	do	3.8
October 9	do	6.3	July 9	do	4.9
December 2	do	5.4	July 31	W. A. Lamb	5.9
			August 12	do	5.1
1908.			August 24	do	5.8
February 28	R. B. Post	3.9	September 14	do	3.5
March 21	do	4.0	November 5	A. T. Barrows	5.4

THIBAUT CREEK NEAR INDEPENDENCE, CAL.

A regular station was established on this creek February 13, 1908, at a point about 1 mile west of the county road between Independence and Big Pine and about 5 miles north of Independence. No gage record has been kept.

The following measurements were made during 1907 and 1908:

Discharge measurements of Thibaut Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	G. R. Shuey				1.7
May 24	do				1.7
June 28	do				1.2
August 31	R. B. Post				.9
December 2	do				.9
1908.					
February 13	R. B. Post	3	1.4	0.25	.8
April 3	do	3	1.4	.33	1.0
May 6	do	1	.3		.2
July 8	do	3	1.0	.29	.6
July 31	W. A. Lamb	3	1.2	.29	.63
August 12	do	3	1.2	.40	.60

OAK CREEK NEAR INDEPENDENCE, CAL.

The original station was put in about 1 mile west of old Fort Independence on June 15, 1905. A new station was established October 1, 1906, at Bell's flour mill, about 3 miles northwest of Independence. This station was discontinued April 19, 1907, and replaced by another above and about three-fourths of a mile west of the mill, where the conditions were better,

Discharge measurements of Oak Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 21	G. R. Shuey	12	6	0.23	9.6
February 24	do	11	6.2	.23	12
March 19	do	12	6.6	.31	20
April 11	do	12	6.0	.29	15
April 19	do	14	13	.50	23
May 24	do	14	14	.58	28
June 14	do	13	14	.60	31
June 28	do	14.5	17	.80	54
July 10	do	15	17	.80	58
August 2	Shuey and Post	14	16	.76	52
August 15	R. B. Post	13	13	.63	32
August 31	do	14	12	.54	25
September 9	do	12	9.6	.45	18
October 9	do	14	9.8	.41	14
October 31	do	12	9.6	.40	14
November 19	do	12	9.4	.44	15
November 26	do	12.5	9.4	.40	12
1908.					
February 8	R. B. Post	12	7.6	.31	8.4
March 24	do	12	7.8	.35	9.9
April 11	do	13	8.6	.32	9.9
April 22	do	14	9.6	.43	15
May 4	do	14	9.6	.44	15
May 30	do	12	9.4	.44	16
June 11	do	13	11.0	.49	20
June 24	do	13	11.0	.53	23
July 1	do	13	11.0	.58	22
July 11	do	14	13.0	.63	30
July 28	W. A. Lamb	15	13.0	.60	28
August 11	do	14	12.0	.59	29
August 31	do	13	9.4	.37	13
September 22	do	13	9.2	.37	13
October 14	do	13	8.6	.34	12
October 26	A. T. Barrows	14	9.7	.32	13
November 2	do	14	9.4	.34	12
November 14	do	14	9.0	.32	11

Daily gage height, in feet, of Oak Creek near Independence, Cal., for 1907 and 1908.

[A. N. Bell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.2	0.25	0.2	0.25	0.5							
2	.2	.25	.2	.25			0.8	0.7	0.55	0.45	0.4	0.4
3	.2	.25	.2	.25	.5	0.8	.9					
4	.2	.25	.2	.25		.8	1.0		.55	.45		.4
5	.2	.25	.2	.25			1.0	.7			.4	
6	.2	.25	.25	.25	.5	.75			.5			.4
7	.25	.25	.3	.25		.7		.6		.45	.4	
8	.25	.25	.25	.25	.5		.9		.5			.4
9	.25	.25	.25	.25		.65		.6		.4	.4	
10	.25	.25	.25	.25			.8					.4
11	.25	.25	.25	.3	.55		.8	.6	.45	.4	.4	
12	.25	.2	.25	.3						.4		
13	.25	.2	.25	.35	.5	.65	.85	.6			.4	.4
14	.25	.2	.25	.4			.85	.65	.45	.4		
15	.25	.2	.25	.4	.5	.6		.65			.4	.4
16	.25	.2	.25	.4			.8		.45	.4		
17	.25	.2	.3	.4	.55	.6	.8			.4	.4	.4
18	.25	.2	.3	.4	.6	.55			.45			
19	.25	.2	.35	.4			.8	.5		.4	.4	.4
20	.25	.2	.35	.4	.6				.45	.4		
21	.25	.2	.3			.7	.8	.5			.4	.4
22	.25	.2	.3	[a] .55	.6	.7				.4		.4
23	.25	.2	.3				.7	.55	.45		.4	
24	.25	.2	.3	.55	.6	.6			.45			.4
25	.25	.2	.3		.6	.6	.7		.45	.45	.4	
26	.25	.2	.3					.55		.45		.4
27	.25	.2	.3	.6	.6	.8	.7		.45		.4	
28	.25	.2	.25		.6	.8		.55		.4		.4
29	.25		.25	.55			.7				.4	
30	.25		.25		.65	.9			.45	.4		.4
31	.25		.25		.7		.7	.55				

[a] New station.

Daily gage height, in feet, of Oak Creek near Independence, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	0.3					0.45			0.4		0.35	0.35
2		0.35	0.3	0.3	0.5	.45	0.6	0.6		0.4		
3	.3								.35			.3
4		.35		.35	.5		.65	.6		.4	.35	.3
5	.3		.35			.45						
6			.35	.35	.45		.65	.6	.4	.35	.35	.3
7	.3	.35			.4	.45						
8		.3		.35			.65	.6	.4	.35	.35	.3
9	.3				.4	.5						.3
10		.3	.3	.35			.65	.6	.4	.35	.35	
11	.3			.3		.5				.35		
12		.3	.3		.4		.65	.55	.45		.35	.3
13				.35		.55				.4	.3	
14	.3		.3	.35	.4	.55	.6		.5			.3
15		.3		.4				.55		.35	.3	
16	.3		3		.4	.55	.6		.45		.3	.3
17		.3		.4	.4			.5	.4	.35		
18	.3		.3			.5	.6	.5		.35	.3	.3
19	.3	.3		.4	.4				.4			
20						.5	.6	.5		.35	.3	.3
21			.3	.4	.4	.55			.4			
22	.3	.35	.35				.6	.5		.35	.3	.3
23				.4	.4	.55		.5	.4			
24	.3	.3	.35		.45		.6		.4	.35	.3	.3
25				.4		.6		.45				
26		.3			.5		.6		.4	.35	.35	
27	.3		.35	.45				.45				.3
28					.5	.6	.6		.4		.35	
29	.35	.3	.35	.45				.4		.35		.3
30				.5		.6	.6	.4	.4		.35	
31	.35		.35				.6			.35		.3

Monthly discharge of Oak Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	11	10	10.8	664	C.
February	11	10	10.4	578	C.
March	17	10	12.2	750	C.
April	31	11	18.8	1,120	C.
May	43	21	26.9	1,650	C.
June	62	31	42.2	2,510	C.
July	88	43	57.0	3,500	C.
August	43	21	32.8	2,020	C.
September	31	17	20.4	1,210	C.
October	17	13	14.5	892	C.
November	13	13	13.0	774	C.
December	13	13	13.0	799	C.
The year	88	10	22.7	16,500	
1908.					
January	11	8.6	10.0	615	C.
February	11	8.6	9.2	529	C.
March	11	8.6	9.3	572	C.
April	20	8.6	12.3	732	C.
May	20	13	15.8	972	C.
June	27	11	21.0	1,250	C.
July	31	27	29.0	1,780	C.
August	28	12	22.5	1,380	C.
September	20	12	15.5	922	C.
October	14.5	12.5	13.0	799	C.
November	12.5	10.4	11.6	690	C.
December	12.5	10.4	10.5	646	C.
The year	31	8.6	15.0	10,900	

NOTE.—From January 1 to April 20, 1907, records kept in flume. During the remainder of the year record kept at new station. Daily discharges for 1907 were obtained by indirect method for shifting channels. The daily discharges for 1908 were obtained from several rating tables covering short periods of time.

INDEPENDENCE CREEK NEAR INDEPENDENCE, CAL.[a]

The original station at the city waterworks, which was established June 15, 1905, was destroyed in June, 1906. On August 20, 1906, a new station was established at a point about 300 feet above the city waterworks and 1 mile west of Independence.

Discharge measurements of Independence Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 24	G. R. Shuey	9	5.2	0.30	3.0
March 19	do	10	8.6	.60	10.0
April 16	do	10	11	.80	19
May 23	do	10.5	13	1.10	33
June 3	do	11	16	1.30	69
June 28	do	11	15	1.40	66
July 10	do	12	13	1.45	64
August 14	R. B. Post	10	8.6	1.00	25
August 30	do	10	7.0	.85	14
September 26	do	3.5	2.4	.60	5.3
October 19	do	4.5	3.1	.68	6.8
October 31	do	4.5	3.4	.77	8.4
November 11	do	4	2.8	.68	5.6
November 30	do	4	2.7	.64	4.7
1908.					
February 6	R. B. Post	4.5	2.2	.52	2.6
February 27	do	3.5	2.1	.54	2.7
March 14	do	3.5	2.2	.56	2.8
March 24	do	10	5.6	.63	5.4
April 10	do	9	4.5	.60	4.7
April 23	do	11	7.7	.82	11
May 1	do	10	9.3	1.00	18
May 9	do	10	8.5	.96	16
June 1	do	10	8.7	1.01	19
June 11	do	10	8.9	1.01	20
June 23	do	10	10.0	1.10	23
July 1	do	10	9.7	1.18	26
July 11	do	11	12	1.20	34
July 20	W. A. Lamb	12	11	1.08	27
July 28	do	12	11	1.08	28
August 6	do	12	11	1.10	30
August 22	do	12	7.6	.79	15
September 1	do	11	6.9	.71	11
September 21	do	10	6.2	.68	8.8
October 3	do	10	6.0	.67	9.4
October 14	do	10	5.6	.63	7.2
October 26	A. T. Barrows	11	6.4	.63	8.2
November 2	do	12	6.6	.64	8.0
November 11	do	12	6.2	.62	5.8

[a] This creek is called Little Pine Creek on the United States Geological Survey's topographic map of the Mount Whitney quadrangle, but is commonly known as Independence Creek.

Daily gage height, in feet, of Independence Creek near Independence, Cal., for 1907 and 1908.

[Le Roy Roeper, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.4	0.4	0.3	0.4			1.5		0.9	0.6		
2					0.9						0.7	0.7
3	.5	.4	.3	.5		1.1	1.5		1.0	.6		
4					.8			1.2			.7	.7
5	.4	.3	.35	.5	.8	1.3	1.7		1.0	.6		
6								1.3			.7	7
7		.4	.3	.4	.8	1.3	1.6		.9	.6		
8								1.1			.7	.7
9		.3	.3	.5	.9	1.2	1.5		1.0	.6		
10						1.3		1.1			.7	.7
11		.3	.35	.7	.95					.6		
12					.9	1.1		1.0			.7	.7
13	.5	.3	.3	.6			1.4		1.0	.6	.7	
14					.8	1.0		1.0			.7	.7
15	.4	.3	.4	.7			1.3		.9	.6		
16					1.0	1.2					.9	.7
17		.3		.8	1.1		1.3		1.0	.6		
18	.4							1.1			.7	.7
19		.3		.8	.9				.9	.7		
20	.4		.6					1.1			.7	.7
21		.3		.9	.8				.8	.7		
22	.4		.4					1.0			.7	.7
23		.35		.9	.9				.7	.7		
24	.5		.5					1.1			.7	.7
25		.4		.8	.9		1.4			.8		
26	.5		.5					1.0			.7	.7
27		.3		.9			1.3			.8		
28	.4		.4					1.2			.7	
29				.8		1.4	1.2	1.3		.8		.7
30	.4		.4								.7	
31	.5							1.2		.8		.7
1908.												
1		.6		.6		.9		1.1		.7		
2	.6		.5		1.0		1.2		.7		.65	.65
3		.6		.6		1.0		1.1		.7		
4	.6		.5		1.0		1.2		.65		.65	.6
5		.6		.6		1.0		1.1		.7		
6	.6		.5		1.0		1.2		.6		.65	.6
7		.5		.6		1.0		1.1		.7		
8	.6		.55		.95		1.1		.6		.6	.6
9		.5		.6		1.0		1.1		.7		
10	.6		.55		.9		1.1		.7		.6	.6
11		.5		.6		1.05		1.05		.7		
12	.6		.5		.9		1.1		.6		.6	.6
13		.5		.65		1.1		1.0		.7		
14	.6		.55		.9		1.1		.6		.6	.6
15		.5		.7		1.1		.95		.7		
16	.6		.6		.85		1.1		.6		.6	.6
17		.5		.7		1.1		.9		.7		
18	.6		.6		.85		1.1		.6		.6	.6
19		.5		.75		1.15		.9		.6		
20	.6		.6		.9		1.05		.6		.6	.6
21		.5				1.1		.85		.6		
22	.6		.6	.8	.9		1.0		.65		.6	.6
23		.5				1.1		.8		.6		
24	.6		.6	.8	.95		1.05		.7		.6	.6
25		.5				1.0		.8		.65		
26	.6		.6	.8	.9		1.1		.7		.6	.6
27		.5				1.0		.75		.65		
28	.6		.6	.85	1.0		1.1		.7		.6	.6
29		.5				1.1		.7		.65		
30	.6		.6	.9	1.0		1.1		.7		.6	.6
31								.7		.65		

Monthly discharge of Independence Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	7	4.5	5.5	338	B.
February	4.5	3.0	3.5	194	B.
March	10	3	4.9	301	B.
April	25	4.5	14.9	887	B.
May	43	19	26.0	1,600	B.
June	93	33	62.0	3,690	C.
July	137	43	70.6	4,340	C.
August	53	25	35.8	2,200	C.
September	25	4.9	16.7	994	C.
October	11	4.6	6.6	406	C.
November	17	6.9	7.6	452	C.
December	6.9	6.9	6.9	424	C.
The year	137	3	21.8	15,800	
1908.					
January	4.3	4.3	4.3	264	C.
February	4.3	2.0	2.4	138	C.
March	4.3	2.0	3.4	209	C.
April	14	4.3	7.4	440	C.
May	19	12	15.7	965	C.
June	27	14	21.5	1,280	C.
July	35	22	29.0	1,780	C.
August	28	10	19.9	1,220	C.
September	10	6.1	8.3	494	C.
October	10	6.1	9.0	553	C.
November	8.2	6.1	6.6	393	C.
December	8.2	6.1	6.3	387	C.
The year	35	2	11.2	8,120	

NOTE.—Daily discharges for days without gage record were interpolated between measurements. The daily discharges were obtained from several rating tables covering short periods of time.

SHEPARD CREEK NEAR THEBE, CAL.[a]

No regular station has been maintained on this stream, but a sufficient number of measurements were made during 1907 and 1908 to justify a rough estimate of the monthly flow. All measurements were made at a point about 3 miles east of the mouth of the creek's canyon.

Discharge measurements of Shepard Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	1908.		*Sec.-ft.*
January 30	G. R. Shuey	2.0	February 10	R. B. Post	1.0
February 24	do	2.7	February 29	do	1.6
March 22	do	3.8	March 11	do	1.3
April 16	do	9.7	April 4	do	0.7
May 4	do	9.1	April 17	do	1.4
May 20	do	13	April 30	do	6.3
June 5	do	31	May 8	do	6.3
June 15	do	20	May 15	do	5.4
June 27	do	30	June 8	do	8.2
July 9	do	39	June 23	do	11
July 31	do	36	July 3	do	24
August 12	R. B. Post	23	July 13	Post and Lamb	18
August 28	do	14	July 24	W. A. Lamb	17
September 11	do	3.3	August 9	do	34
September 27	do	3.3	August 17	do	18
October 17	do	6.1	September 2	do	6
November 4	do	4.9	October 1	do	8.5
November 24	do	4.6	October 20	Barrows and Lamb	4.7
December 14	do	2.7	November 3	do	3.0
			November 11	A. T. Barrows	2.5

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Shepherds Creek near Independence.

Monthly discharge of Shepard Creek near Thebe, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January			2.0	123
February			2.4	133
March			3.4	209
April			8.1	482
May			14.0	861
June			26.0	1,550
July			37.0	2,280
August			21.0	1,290
September			4.7	280
October			5.1	314
November			4.7	280
December			2.9	178
The year			11.0	7,980
1908.				
January			[a] 1.3	80
February			[a] 1.3	75
March			[a] 1.3	80
April	6.4	0.7	2.6	155
May	7.0	5.4	6.2	381
June	22	7.1	13.4	797
July	28	17	22.0	1,350
August	34	6.7	21.0	1,290
September	18	6.0	9.6	571
October	8.5	3.6	5.7	350
November	3.4	2.5	2.6	155
December			[a] 2.0	123
The year			7.4	5,410

[a] Estimated.

NOTE.—Daily discharges for 1907 and April to November, 1908, were obtained by interpolation between the measurements. The monthly estimates of flow for 1907 and 1908 are only approximate.

BAIRS CREEK NEAR THEBE, CAL.[a]

No regular station has been maintained at this point, but during 1907 and 1908 enough measurements were made to justify a rough estimate of the monthly flow. All measurements were made at a point about 3 miles east of the mouth of the canyon.

Discharge measurements of Bairs (Moffett) Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	1908.		*Sec.-ft.*
March 22	G. R. Shuey	3.5	February 10	R. B. Post	0.0
April 16	do	7.2	April 17	do	.9
May 20	do	9.6	April 30	do	2.8
June 5	do	14	May 8	do	4.9
June 15	do	10	May 15	do	3.8
June 27	do	13	June 23	do	6.2
July 9	do	15	July 3	do	3.7
July 31	do	5.9	August 9	W. A. Lamb	8.2
August 12	R. B. Post	4.4	August 17	do	4.5
August 28	do	3.9	September 2	do	1.5
September 11	do	.6	October 1	do	2.9
October 17	do	1.8	November 12	A. T. Barrows	1.7
November 4	do	2.6			
November 24	do	1.6			
December 14	do	15			

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Moffett Creek near Independence.

Monthly discharge of Bairs (Moffett) Creek near Thebe, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	[a] 1.0	61	January	[a] 1.0	61
February	[a] 1.0	56	February	[a] .0	0
March	3.0	184	March	[a] .0	0
April	7.0	417	April	1.2	71
May	9.6	590	May	3.0	184
June	12.2	726	June	4.0	238
July	11.7	719	July	4.5	277
August	4.4	270	August	4.0	246
September	1.1	65	September	1.6	95
October	1.7	104	October	[a] 1.4	86
November	2.1	125	November	[a] 1.2	71
December	1.5	92	December	[a] 1.0	61
The year	4.7	3,410	The year	1.9	1,390

[a] Estimated.

NOTE.—Daily discharges, March to December, 1907, and April to September, 1908, were obtained by interpolation between measurements. The monthly estimates of flow are only approximate.

GEORGE CREEK NEAR THEBE, CAL.[a]

A gage has been placed on this creek at a point about 1 mile west of the road from Independence to Lone Pine, and all measurements during 1907 and 1908 were made there.

No gage record was kept during 1907 and 1908, but a rough estimate has been made of the monthly flow.

Discharge measurements of George Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
February 24	G. R. Shuey	6.8	3.3	.....	2.7
March 22	do	8	5.7	0.95	5.6
April 16	do	8.5	6.8	1.20	12
May 4	do	9	8	1.20	14
May 20	do	9	8.7	1.35	19
June 15	do	8	7.5	1.20	16
July 9	do	9	11	1.55	33
August 12	R. B. Post	8	7.3	1.20	14
August 28	do	8	6.2	1.05	8.7
September 11	do	8	5.1	.89	4.4
September 27	do	8	4.4	.79	2.0
October 19	do	8	6.4	1.01	6.8
November 4	do	8	5.7	.99	6.1
November 24	do	8	4.3	.82	2.8
December 14	do	8	4.1	.80	2.3
1908.					
February 10	R. B. Post	8	3.1	.68	1.5
February 29	do	8	3.8	.75	1.7
March 11	do	8	3.6	.75	1.8
April 4	do	8	4.2	.80	2.6
April 17	do	8	4.2	.82	2.8
April 30	do	8.5	7.6	1.18	14
May 8	do	8	6.3	1.03	8.6
May 15	do	6.5	5.7	.95	6.1
June 8	do	8.5	4.8	.85	6.8
June 23	do	9	6.3	1.09	12
July 3	do	9	8.1	1.20	19
July 13	Post and Lamb	8.5	7.1	1.15	18
July 24	W. A. Lamb	9	7.7	1.10	14
August 9	do	9	8.9	1.15	22
August 17	do	9	7.0	.95	11
September 2	do	9	5.4	.80	7.1
October 1	do	9	5.8	.87	8.7
October 20	Lamb and Barrows	8	4.3	.75	4.0
October 30	A. T. Barrows	4	3.4	.....	5.8
November 3	Lamb and Barrows	8.5	4.8	.67	3.4
November 12	A. T. Barrows	9	4.5	.64	3.0

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Georges Creek near Independence.

Monthly discharge of George Creek near Thebe, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	2.0	123	January	2.7	166
February	2.5	139	February	1.9	109
March	5.0	307	March	2.2	135
April	11.0	655	April	5.3	315
May	17.0	1,040	May	8.0	492
June	19.0	1,130	June	11.0	655
July	28.0	1,720	July	18.0	1,110
August	13.0	799	August	14.0	861
September	4.0	238	September	8.1	482
October	5.2	320	October	6.0	369
November	3.8	226	November	3.2	190
December	2.3	141	December	3.0	184
The year	9.4	6,840	The year	7.0	5,070

NOTE.—Daily discharges were obtained by interpolation between the measurements. These monthly means are only approximate.

LONE PINE CREEK NEAR LONE PINE, CAL.

This station was established September 25, 1906, at a point about three-fourths of a mile west of the town of Lone Pine and about 500 feet above the division boxes on the creek.

Discharge measurements of Lone Pine Creek near Lone Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	G. R. Shuey	7	4.2	1.67	5.6
February 23	do	7	4.5	1.70	6.9
March 21	do	7	5.2	1.80	9.6
April 16	do	6.5	7.1	2.05	21
May 21	do	7	8.8	2.30	32
June 5	do	7	11	2.60	46
June 27	do	8	14	2.85	69
July 9	do	7.5	13	2.80	74
July 30	do	6.5	11	2.60	54
August 12	R. B. Post	6	7.6	2.33	30
August 29	do	6.5	9.8	[a] 2.60	26
September 10	do	6.5	8.2	2.40	15
September 28	do	6.0	5.9	2.10	8.6
October 13	do	6	7.1	2.25	9.5
October 23	do	6	9	2.49	17
November 7	do	6	7.2	2.31	9.7
November 22	do	6	7.1	2.22	9.0
1908.					
February 1	R. B. Post	6	8	2.05	8.1
March 16	do	6	6.8	2.23	8.7
April 16	do	6	7.6	2.34	10
April 27	do	6	9.3	2.49	16
May 19	do	6	7.0	2.40	10
May 27	do	6.5	9.0	2.55	16
June 5	do	6	8.0	2.51	12
June 14	do	7.5	12	2.90	29
July 2	do	7.5	14	3.00	38
July 21	W. A. Lamb	8	15	3.00	39
August 7	do	10	20	3.40	73
August 18	do	6.5	12	2.85	29
September 7	do	7.5	13	3.00	32
September 10	do	8	16	3.20	49
September 23	do	7	11	2.62	19
October 18	do	7	9.4	2.45	10
October 28	A. T. Barrows	7	9.7	2.42	11
November 21	do	7.5	9	2.25	6.6

[a] Change in channel section.

Daily gage height, in feet, of Lone Pine Creek near Lone Pine, Cal., for 1907 and 1908.

[A. J. Gallaher, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.8		1.8	1.7			2.8				2.7	2.2
2		1.7				2.5			2.4	2.1		
3	1.8		1.8	1.7				2.6				
4		1.7					3.0				2.65	2.2
5	1.8		1.8	2.0		2.6			2.4	2.3		
6		1.7						2.6				
7	1.8		1.8	2.0			3.0				2.6	2.2
8		1.7				2.45			2.4	2.3		
9			1.8	2.0				2.5				
10	1.8	1.7					2.8				2.6	2.2
11			1.6	2.0		2.5			2.4	2.3		
12	1.8							2.4				
13	1.8		1.6	2.0			2.8				2.3	2.1
14		1.7				2.4			2.4	2.3		
15	1.8		1.8	2.0				2.4				
16							2.6				2.2	2.1
17	1.7	1.7	1.8	2.05		2.2			2.4	2.6		
18								2.4				
19	1.7	1.7	1.8	2.2			2.7				2.2	2.1
20	1.7					2.3			2.2	2.5		
21	1.7	1.7	1.8	2.15				2.4				
22							2.7				2.2	2.1
23	1.7	1.7	1.8	2.2		2.6			2.2	2.6		
24							2.7	2.3				
25	1.7	1.7	1.8	2.2			2.7				2.2	2.05
26						2.8			2.1	2.75		
27	1.7	1.7	1.8	2.2				2.2				
28							2.5				2.15	2.1
29	1.7		1.8	2.1		2.8		2.6	2.0	2.7		
30								2.8				
31	1.7		1.8				2.6					2.1
1908.												
1		2.05		2.3	2.55		3.0				2.45	2.25
2			2.1						2.6	2.6		
3	2.05					2.65		3.75				
4		2.0		2.3	2.65		3.05				2.35	2.25
5			2.1						2.6	2.5		
6	2.05					2.65		3.75				
7		2.0		2.25	2.65		3.1				2.35	2.25
8			2.1						3.0	2.5		
9	2.05					2.8		3.55				
10		2.05		2.3	2.7		3.15				2.35	2.25
11			2.15						3.0	2.45		
12	2.05					2.9		3.5				
13		2.1		2.3	2.65		3.2				2.35	2.3
14			2.15						2.8	2.45		
15	2.0					2.95		3.4				
16		2.1		2.4	2.6		3.2				2.3	2.3
17			2.2						2.65	2.45		
18	2.0					3.0		3.3				
19		2.1		2.4	2.5		3.1				2.25	2.25
20			2.2						2.6	2.45		
21	2.0					3.0		2.7				
22		2.35		2.45	2.45		3.0				2.25	2.15
23			2.25						2.6	2.45		
24	2.2					3.05		2.7				
25		2.2		2.5	2.5		3.0				2.2	2.15
26			2.25						2.8	2.45		
27	2.2					3.05		2.6				
28		2.1		2.5	2.55		3.0				2.25	2.15
29			2.25						2.75	2.45		
30						3.1		2.6				
31					2.65		3.0					2.15

Monthly discharge of Lone Pine Creek near Lone Pine, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	9.5	6.5	8.2	504	C.
February	6.5	6.5	6.5	361	C.
March	9.5	4.0	8.8	541	C.
April	27	6.5	19.5	1,160	C.
May			[a] 30.0	1,840	D.
June	65	27	45.6	2,710	C.
July	80	44	61.5	3,780	C.
August	51	26	39.5	2,430	C.
September	23	7.9	11.5	684	C.
October	38	8.1	19.6	1,210	C.
November	34	8.6	16.2	964	C.
December	8.9	8.1	8.5	523	C.
The year	80	4.0	23.0	16,700	
1908.					
January			[a] 8.0	492	D.
February	10	7.0	7.7	443	C.
March	9.5	7.5	8.2	504	C.
April	16	8.9	11.3	672	C.
May	22	13	17.4	1,070	C.
June	45	14	32.0	1,900	C.
July	54	38	44.0	2,700	C.
August	110	18	58.0	3,570	C.
September	54	16	24.0	1,430	C.
October	16	10	11.3	695	C.
November	10	6.5	7.6	452	C.
December	7.5	5.5	6.3	387	C.
The year	110	5.5	19.6	14,300	

[a] Estimated.

NOTE.—The daily discharges were obtained from several rating tables covering short periods of time.

TUTTLE CREEK NEAR LONE PINE, CAL.

Regular measurements were made on this creek during 1907 and 1908 near Lone Pine, at a point where the stream leaves the foothills and enters the valley. An incomplete gage height record was kept during 1907 and 1908, but it is of little value on account of continual changes at the gaging section.

Discharge measurements of Tuttle Creek near Lone Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	G. R. Shuey	9	4.2	1.10	5.4
February 23	do	9	4.7	1.02	6.4
March 21	do	8	4.0	1.02	5.3
April 16	do	8.5	4.2	1.00	5.7
May 21	do	8	4.7	1.10	85
June 5	do	9	6.4	1.25	12
June 27	do	8	7.6	1.35	18
July 9	do	8.5	9.9	1.55	28
July 30	do	9	9.6	1.50	21
August 12	R. B. Post	8	7.2	1.33	14
August 29	do	8	6.8	1.20	12
September 10	do	8	5.6	1.12	8.4
September 28	do	8	4.8	1.07	5.9
October 12	do	8.5	5.2	1.10	6.1
October 23	do	8.5	5.7	1.17	7.4
November 7	do	8.5	5.3	1.14	6.8
November 22	do	8	5.3	1.12	6.3

Discharge measurements of Tuttle Creek near Lone Pine, Cal., in 1907 and 1908—Con.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 1	R. B. Post	9.5	5.4	1.10	4.5
March 16	do	8.5	4.4	1.05	5.1
April 16	do	8	4.9	1.08	5.3
April 27	do	8	4.9	1.05	5.8
May 19	do	8.5	4.7	1.02	6.0
May 27	do	8.5	4.5	1.02	5.5
June 5	do	8.5	5.0	1.08	6.7
June 14	do	8.5	6.3	1.11	10
July 2	do	8	6.4	1.20	11
July 21	W. A. Lamb	8.5	7.4	1.20	15
August 7	do	8.5	8.4	1.32	21
August 18	do	8	7.0	1.19	14
September 7	do	8	6.2	1.11	10
September 23	do	8	6.0	1.10	10
October 18	do	8	5.4	1.10	8.2
October 28	A. T. Barrows	8	5.7	1.10	8.1
November 21	do	8	5.3	1.10	7.1

Daily gage height, in feet, of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908.

[John Anton and A. J. Gallaher, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.2	1.2	1.2	1.0			1.4				1.2	1.1
2						1.2			1.2	1.0		
3	1.2	1.2	1.2	1.0				1.45				
4							1.5				1.25	1.1
5	1.2	1.2	1.2	1.0		1.25			1.2	1.2		
6								1.5				
7	1.2	1.2	1.2	1.0			1.5				1.25	1.1
8						1.25			1.2	1.1		
9	1.2	1.2	1.2	1.0				1.4				
10							1.55				1.2	1.1
11	1.2	1.2	1.2	1.0		1.2			1.1	1.1		
12								1.3				
13	1.2	1.2	1.2	1.0			1.5				1.2	1.05
14						1.3			1.2	1.1		
15	1.2	1.2	1.0	1.0				1.3				
16							1.25				1.1	1.1
17	1.2	1.2	1.0	1.0		1.4			1.2	1.25		
18								1.3				
19	1.1	1.2	1.0	1.2			1.3				1.1	1.1
20						1.2			1.1	1.1		
21	1.1	1.2	1.0	1.2				1.3				
22							1.3				1.1	1.1
23	1.1	1.2	1.0	1.2		1.8			1.1	1.2		
24								1.3				
25	1.1	1.2	1.0	1.2			1.3				1.1	1.05
26						1.7			1.1	1.25		
27	1.1	1.2	1.0	1.2			1.25	1.2				
28											1.05	1.1
29	1.1		1.0	1.2		1.5			1.1	1.2		
30								1.2				
31	1.1		1.0				1.5					1.1
1908.												
1		1.1		1.3	1.25		1.15				1.1	1.1
2			1.1						1.1	1.1		
3	1.05					1.1		1.25				
4		1.05		1.3	1.25		1.2				1.1	1.1
5			1.1						1.1	1.1		
6	1.05					1.15		1.3				
7		1.05		1.25	1.25		1.2				1.1	1.1
8			1.1						1.1	1.05		
9	1.05					1.15		1.3				
10		1.1		1.3	1.3		1.25				1.1	1.1

Daily gage height, in feet, of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11			1.15						1.5	1.1		
12	1.05					1.15		1.25				
13		1.1		1.3	1.25		1.3				1.1	1.1
14			1.15						1.15	1.1		
15	1.0					1.2		1.25				
16		1.1		1.4	1.2		1.2				1.1	1.1
17			1.2						1.1	1.1		
18	1.0					1.25		1.2				
19		1.1		1.4	1.0		1.15				1.1	1.1
20			1.2						1.1	1.1		
21	1.0					1.25		1.2				
22		1.25		1.15	1.0		1.15				1.1	1.05
23			1.25						1.1	1.1		
24	1.2					1.3		1.2				
25		1.2		1.2	1.05		1.1				1.1	1.05
26			1.25						1.15	1.1		
27	1.2					1.3		1.15				
28		1.1		1.2	1.1		1.1				1.1	1.05
29			1.25						1.1	1.1		
30						1.35		1.15				
31					1.1		1.1					1.05

Monthly discharge of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	7.4	455	January	5.0	307
February	8.5	472	February	4.5	259
March	7.4	455	March	5.0	307
April	7.3	434	April	5.5	327
May	[a] 9.0	553	May	6.0	369
June	17.1	1,020	June	10.0	595
July	18.8	1,160	July	14.0	861
August	15.0	922	August	15.0	922
September	7.1	422	September	12.0	714
October	7.8	480	October	8.0	492
November	7.6	452	November	7.0	417
December	5.9	363	December	7.0	430
The year	9.9	7,190	The year	8.2	6,000

[a] Estimated.

NOTE.—The daily discharges were obtained by the indirect method for shifting channels. The monthly means are only approximate.

COTTONWOOD CREEK NEAR OLANCHA, CAL.

Cottonwood Creek discharges into Owens Lake. The original station on this creek was established September 25, 1906, at a point about one-fourth mile above the crossing of the Los Angeles aqueduct and about 15 miles south of Lone Pine. A new station was established September 9, 1908, at a point 100 feet above the head of the diversion pipe of the Los Angeles aqueduct.

Discharge measurements of Cottonwood Creek near Olancha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 31	G. R. Shuey	10.5	9.8	0.55	11
February 22	do	10.5	10	.60	11
April 17	do	11	19	1.35	51
May 21	do	10.5	30	2.20	144
June 4	do	11	30	2.30	157
June 19	do	11	24	1.70	89
June 25	do	11	23	1.70	84
July 30	do	10.5	18	1.20	40
August 13	R. B. Post	9	14	1.00	30
August 28	do	9	12	.87	19
September 11	do	9	10	.70	13
September 27	do	9	9.6	.56	9.7
October 13	do	9	14	.82	19
October 23	do	9	17	1.20	43
November 8	do	9	14	.89	24
November 23	do	9	12	.75	15
1908.					
January 31	R. B. Post	9	10	.77	12
March 4	do	11	13	.69	16
April 15	do	10	18	1.29	49
April 26	do	10	21	1.63	82
May 28	do	10	18	1.33	50
June 5	do	10	17	1.29	45
June 14	do	10	16	1.16	39
July 22	W. A. Lamb	12	13	.80	22
July 23	do	12	13	.80	20
August 8	do	10	13	.90	24
August 19	do	12	13	.80	19
September 9	do	10	10	1.86	16
September 24	do	10	12	2.05	21
October 19	do	11.5	11	1.90	18
October 29	A. T. Barrows	7	9.8	1.88	20
November 20	do	10	6.2	.48	7.6

Daily gage height, in feet, of Cottonwood Creek near Olancha, Cal., for 1907 and 1908.

[L. T. Waldorf, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5	0.55					1.75	1.3	0.8	0.55		0.8
2			0.6	0.65								
3	.5	.55					1.75	1.4	.8	.5		.7
4				.65							1.2	
5	.5	.55	.6				1.75		.75	.8		.6
6				.65				1.2			.8	
7		.55	.6						.75			
8	.5							1.15		1.0		.9
9			.6	.9			1.7				.8	
10	.5	.55		1.3				1.1	.7	.9		.8
11						2.1	1.65		.7		.9	
12	.6	.55	.65							.8		.8
13				1.45		2.1	1.6	1.0	.7		.8	
14		.55	.65									
15	.5			1.3		2.1		1.0		.7	.7	.8
16		.6	.65				1.5					
17	.5			1.35				1.0	.6	1.4	.5	.7
18						1.7	1.5					
19	.5	.6	.7						.6	1.1	.5	.8
20				1.6		1.6	1.4	.95	.6			
21		.6	.75								.5	
22	.6					1.8		.9		1.0		.8
23		.6	.7	1.65			1.3					
24	.6	.6						.9	.6	1.25	.75	.75
25				1.85		1.7	1.3					
26	.6	.6	.65					.9	.55	1.2	.8	.75
27				1.9		1.8	1.3					
28		.6	.65					.85	.55	1.2	.8	
29	.6					1.8						.75
30			.65	1.8			1.2	.85			.8	
31	.55											.75

Daily gage height, in feet, of Cottonwood Creek near Olancha, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1		0.65					1.15				2.0	1.7
2			0.6			1.9	1.15				1.9	1.7
3							1.15				1.9	1.7
4		.65	.7					0.9			1.9	1.7
5			.75				1.1	1.05			1.85	1.7
6							1.1	.95			1.85	1.7
7							1.1	.9			1.9	1.7
8		.65	.7				1.1	.9			2.0	1.7
9							1.1	.9			2.0	1.7
10		.65			1.55		1.05	1.0			2.0	1.65
11					1.55		1.05	.9		1.75	2.0	1.6
12			.7			1.25	1.0	.9		1.75	1.9	1.6
13						1.2	1.0	.8		1.75	1.85	1.6
14		.65				1.2	1.0	.8		1.7	1.9	1.6
15			.7			1.2	1.0	.8		1.75	1.5	1.6
16						1.2	1.0	.8		1.9	1.5	1.6
17		.60				1.2	1.0	.75		1.9	1.4	1.6
18						1.2	1.0	.75		2.0	1.4	1.6
19			.95			1.2	1.05	.75		2.25	1.4	1.5
20						1.2	1.05	.75		2.2	1.5	1.5
21		.6				1.2	1.05	.7		2.45	1.5	1.5
22			1.1			1.1	1.0	.7		2.3	1.6	1.5
23						1.2	1.0	.7		2.1	1.6	1.5
24		.7				1.2	1.0	.65		2.05	1.6	1.5
25						1.1	1.0	.65		2.0	1.5	1.5
26			1.0			1.2	1.0	.6		1.9	1.7	1.5
27							1.0	.6		1.9	1.7	1.5
28		.6				1.09	1.05	.6		1.9	1.6	1.5
29			1.0			1.2	1.05	.6		1.9	1.7	1.5
30						1.2		.5		1.9	1.7	1.5
31					1.7			.6		2.0		1.5

Rating tables for Cottonwood Creek near Olancha, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	9.4	1.00	27	1.50	65	2.00	120
.60	11	1.10	33	1.60	75	2.10	132
.70	13	1.20	40	1.70	85	2.20	144
.80	17	1.30	48	1.80	96	2.30	157
.90	21	1.40	56	1.90	108		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 16 discharge measurements made during 1907, and is well defined between gage heights 0.5 foot and 2.3 feet.

JANUARY 1 TO SEPTEMBER 8, 1908.

0.60	11	1.10	35	1.60	76	2.10	132
.70	15	1.20	42	1.70	86	2.20	145
.80	19	1.30	49	1.80	97	2.30	158
.90	24	1.40	57	1.90	108		
1.00	29	1.50	66	2.00	120		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 14 discharge measurements made during 1908, and is well defined between gage heights 0.8 foot and 1.7 feet.

Monthly discharge of Cottonwood Creek near Olancha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	11	9.4	10.0	615	B.
February	11	10	10.5	583	B.
March	15	11	12.0	738	B.
April	108	12	56.3	3,350	B.
May	.....	.....	[a] 115	7,070	D.
June	.....	.....	[a] 110	6,550	D.
July	90	44	67.1	4,130	B.
August	56	18	28.8	1,770	B.
September	17	10	12.5	744	B.
October	56	9.4	28.0	1,720	B.
November	40	9.4	18.6	1,110	B.
December	21	11	15.8	972	B.
The year	.....	.....	40.4	29,400	
1908.					
January	.....	.....	[a] 12.0	738	D.
February	15	11	12.5	719	B.
March	42	11	22.2	1,360	B.
April	81	29	58.1	3,460	B.
May	86	46	62.2	3,820	B.
June	108	35	48.5	2,890	B.
July	38	22	31.2	1,920	B.
August	32	7	18.7	1,150	B.
September	.....	.....	[a] 18.0	1,070	D.
October	.....	.....	[a] 19.0	1,170	D.
November	20	12.5	16.3	970	D.
December	15.5	13.5	14.4	885	D.
The year	.....	.....	27.8	20,200	

[a] Estimated.

NOTE.—Daily discharges for days having no gage height in 1907 were interpolated.

ASH CREEK NEAR OLANCHA, CAL.

Ash Creek discharges into Owens Lake. The gaging station was established April 15, 1907, at a point just above the forks of the creek near the mouth of the canyon, and about 16 miles south of Lone Pine.

Discharge measurements of Ash Creek near Olancha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	G. R. Shuey	5	1.6	.....	2.9
April 17	do	6	6.2	2.00	16
May 22	do	7	10	2.50	39
June 19	do	6	6.8	2.00	18
July 30	do	4.5	3.0	1.35	4.3
August 14	R. B. Post	4	2.8	1.30	3.9
August 29	do	4	2.6	1.28	3.9
September 11	do	4	2.4	1.21	2.6
September 27	do	5	2.4	1.18	2.1
October 13	do	5	3.2	1.32	3.6
November 8	do	5	3.8	1.59	5.4
November 23	do	5	3.3	1.46	4.1
1908.					
January 31	R. B. Post	5	3.1	1.35	4.1
March 4	do	5	3.8	1.51	4.8
April 15	do	6	5.9	1.87	10.0
April 26	do	6	7.1	2.10	15.0
May 28	do	6	6.5	1.91	11.0
June 4	do	6	6.2	1.85	11.0
June 14	do	5	4.4	1.68	7.0
July 22	W. A. Lamb	5	2.6	1.20	2.4
July 23	do	5	2.7	1.24	2.6
August 8	do	5	2.6	1.20	2.2
September 9	do	5	2.2	1.15	1.8
September 24	do	5	3.4	1.40	4.1
October 19	do	5	2.6	1.28	2.3
October 29	A. T. Barrows	5	2.6	1.25	2.5
November 20	do	5	2.8	1.26	2.4

Daily gage height, in feet, of Ash Creek near Olancha, Cal., for 1908.

[M. S. Watson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.35	.....	.....	.....	1.9	1.4	.....	.....	.....	.....	.....
2	.....	.....	1.5	1.7	.....	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....	1.2	.....	.....	.....
4	.....	1.35	1.5	.....	.....	1.85	.....	.....	.....	.....	.....	1.3
5	.....	.....	.....	1.7	.....	.....	1.4	.....	.....	.....	.....	.....
6	.....	.....	.....	.....	1.85	.....	.....	1.2	.....	.....	.....	.....
7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.25
8	.....	1.35	1.5	.....	.....	1.9	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	1.75	.....	.....	.....	.....	1.3	.....	.....	1.3
10	.....	1.35	.....	.....	1.9	.....	1.4	.....	.....	.....	.....	.....
11	.....	.....	.....	.....	.....	1.7	.....	.....	.....	.....	.....	.....
12	.....	.....	1.5	1.9	.....	.....	.....	1.2	.....	.....	.....	.....
13	.....	.....	.....	.....	1.9	.....	.....	.....	1.5	.....	.....	1.25
14	.....	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	1.5	.....	1.95	.....	.....	.....	.....	.....	.....	1.3
16	.....	.....	.....	1.85	.....	1.6	1.3	1.2	1.2	.....	.....	.....
17	.....	1.3	.....	.....	.....	.....	.....	1.2	.....	.....	.....	.....
18	.....	.....	.....	.....	2.0	.....	.....	.....	.....	.....	.....	1.3
19	.....	.....	1.7	.....	.....	1.55	.....	.....	.....	1.3	.....	.....
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.25	.....
21	.....	1.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	1.8	.....	2.0	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	.....	.....	.....	1.55	.....	.....	.....	.....	1.25	.....
24	.....	1.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	1.75	.....	1.9	.....	.....	.....	.....	.....	.....	.....
27	.....	.....	.....	2.1	.....	.....	.....	.....	1.3	.....	1.25	.....
28	.....	1.55	.....	.....	.....	1.45	.....	.....	.....	.....	.....	1.3
29	.....	.....	1.7	.....	.....	.....	.....	.....	.....	1.25	.....	.....
30	.....	.....	.....	.....	.....	.....	1.2	1.2	1.3	.....	.....	.....
31	1.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Rating table for Ash Creek near Olancha, Cal., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	0.8	1.40	4.0	1.80	9.2	2.10	15.0
1.10	1.5	1.50	5.1	1.90	10.9	2.20	17.3
1.20	2.2	1.60	6.3	2.00	12.8	2.30	20.0
1.30	3.1	1.70	7.7				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based upon fifteen discharge measurements made during 1908 and is well defined between gage heights 1.2 feet and 2.1 feet.

Monthly discharge of Ash Creek near Olancha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January			2.5	154	D.
February			2.5	139	D.
March			2.5	154	D.
April			20.0	1,190	D.
May			39.4	2,420	B.
June			29.4	1,750	B.
July			5.5	338	B.
August			3.5	215	C.
September			2.5	149	D.
October			4.0	246	D.
November			4.5	268	D.
December			4.0	246	D.
The year			10.0	7,270	
1908.					
January			[a] 4.0	246	D.
February	5.7	3.1	3.7	213	C.
March	9.2	5.1	6.6	406	C.
April	15	7.7	10.9	649	C.
May	13	10	11.5	707	C.
June	11	4.6	7.3	434	C.
July	4	2.2	3.2	197	D.
August	2.2	2.2	2.2	135	D.
September	5.1	2.2	3.0	179	D.
October	3.1	2.6	3.0	184	D.
November	2.6	2.6	2.6	155	D.
December	3.1	2.6	3.0	184	C.
The year			5.1	3,690	

[a] Estimated.

NOTE.—The mean for April, 1907, is based upon the last 14 days of the month. Daily discharges from April 17 to August 31 were interpolated between measurements. The monthly means for balance of year are estimated.

MOHAVE RIVER BASIN.

DESCRIPTION.

Mohave River rises on the northern slope of the San Bernardino Mountains, and, flowing in a northerly direction, finally disappears in the sands of the Mohave Desert. This stream has few tributaries, the only ones of importance being West Fork and Deep Creek, which have their source in the higher elevations of the San Bernardino Mountains. The formation is of granite, with a good covering of soil. On the higher elevations there is a considerable growth of

timber, which diminishes on the lower reaches, changing to a light growth of brush and grass and finally merging into the barren desert.

During the greater portion of the year the stream bed is dry below the junction of West Fork and Deep Creek, where the waters disappear in the sand and gravelly bed of the stream. Water again rises at a point lower down on the river above Victorville, where the gaging station was formerly located. Water is diverted above and below the gaging station, but is again returned to the river channel.

Several artesian wells have been sunk along the river above the gaging station, the water being used for irrigation. This stream does not discharge in any large quantity except during an extremely heavy rainfall in the winter months.

The precipitation throughout this basin is very light, with the possible exception of the higher elevation of the San Bernardino Mountains, where there is considerable fall of snow during the winter months, which melts in the early spring.

One station has been maintained in this basin, that on Mohave River at Victorville, Cal., 1899–1906. A list of miscellaneous measurements made in 1908 on streams discharging into Mohave Desert is given on page 335.

SOUTH PACIFIC OCEAN DRAINAGE.

GENERAL FEATURES.

The South Pacific Ocean drainage includes all streams south of San Francisco Bay that drain the western slope of the Coast Range and enter the Pacific, directly or indirectly. The region thus drained has an average width of nearly 50 miles and a total area of about 23,000 square miles. The minimum surface flow of the streams on the west side of the Coast Range is very small, and in many of them all the water disappears in the sand and gravel beds below the canyons. In the winter, however, they are torrential, and discharge large volumes of water. North of Santa Barbara the general course of the streams is northwestward; south of Santa Barbara, however, which is approximately opposite the intersection of the Coast Range by the Tehachapi Range, the general direction is southwestward.

Investigations of flow have been made on the following streams in the South Pacific Ocean drainage:

Cottonwood Creek (Tia Juana River).
Sweetwater River.
San Diego River.
Santa Ysabel Creek (Bernardo River).
San Luis Rey River.
Santa Margarita River.
Santa Ana River.
San Gabriel River.
Los Angeles River.
Malibu Creek.
Santa Clara River.
Ventura River.
Santa Ynez River.
Santa Maria River.
Salinas River.

TIA JUANA RIVER DRAINAGE BASIN.

DESCRIPTION.

Tia Juana River discharges into the Pacific Ocean below San Diego Bay near the Mexican boundary. Its principal tributary, Cottonwood Creek, rises in the Laguna Mountains of the Coast Range, and flows south and west for about 20 miles, where it is joined by Pine Valley Creek from the north; it then flows southwestward 12 miles to its junction with Tia Juana River at the Mexican boundary, about 22 miles east of the coast line. The total drainage area of Cottonwood Creek above its junction with Tia Juana River is approximately 340 square miles. It lies south of the Sweetwater and Otay river basins, and is the most southerly stream in San Diego County. Pine Valley Creek is its only important tributary.

The topography of the basin of Cottonwood Creek is rough throughout, although some valley areas are found above the 3,000-foot contour. Below this elevation the stream flows through a deep, narrow canyon, broken only by a short stretch of open country with comparatively light grade at the junction of Pine Valley Creek. Altitudes range from 600 feet above sea level, where the creek empties into Tia Juana River, to 5,000 feet on the Laguna Mountains.

The Cottonwood basin is very poorly forested. The timber consists of scattered oaks, cottonwoods, and alders, which are confined almost entirely to the small valleys along the stream and to the higher elevations. The mountain slopes are fairly well covered with brush.

The mean annual rainfall varies from 8 to 10 inches along the foothills and from 20 to 30 inches in the mountains.

The basin affords several good reservoir sites. The Barrett reservoir, located at the junction of Pine Valley Creek at an elevation of 1,500 feet; the Morena reservoir on Cottonwood Creek, at the lower end of Morena Valley, 8 miles above the Barrett reservoir; and Pine Valley reservoir on Pine Valley Creek, at the west end of Pine Valley. The Morena and Pine Valley reservoirs are at an elevation of 3,100 feet. All of these reservoirs have been surveyed. The Morena dam is now in course of construction and considerable preliminary work has been done at the Barrett dam, including the building of a low concrete dam to a height of about 20 feet above the bed of the stream. A conduit has been constructed to divert water from Cottonwood and Pine Valley creeks from above the Barrett dam to the lower Otay reservoir in the Otay River basin. This conduit has a capacity of about 60 second-feet, and will divert all the water from these creeks when their combined discharge does not exceed that amount. The city of San Diego receives its water supply from the lower Otay reservoir.

The following gaging stations have been maintained in this basin:

Cottonwood Creek near Jamul, Cal. (1906 to 1908).
Pine Valley Creek near Jamul, Cal. (1906 to 1908).

COTTONWOOD CREEK NEAR JAMUL, CAL.

This station, which was established December 14, 1905, chiefly to determine the amount of water available at the Barrett reservoir, is located near the Barrett dam site near the south line of sec. 15, T. 17 S., R. 3 E., San Bernardino meridian, and about 6 miles above the San Diego Campo road.

Pine Valley Creek enters Cottonwood Creek 1 mile above the gaging station, and Lyons Creek one-half mile above. The drainage area above the station, including that of Pine Valley Creek, is approximately 270 square miles.

Discharge measurements are made at the low concrete dam, back of which sand and gravel have been deposited to the level of its crest. At low stages the flow is restricted to a rectangular wooden flume through the wall of the dam, but at high stages the flow is over the entire length of the dam, which is 61 feet. Measurements are usually made by wading, except in high stages, when only float velocities can be obtained. The results obtained at this station are only fair.

Discharge measurements of Cottonwood Creek near Jamul, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 5	6	7.5	2.25	56	June 27	6	3.5	0.89	14
January 15	85	62	.60	171	December 6	6	3.6	.72	11
February 7	61	25	.38	50					
February 26	61	25	.48	59	1908.				
March 8	61	54	.80	191	January 17	6	4.2	.81	14
March 20	61	32	.60	89	January 27	6	7.2	1.95	52
April 12	61	32	.64	105	February 14	6	8	2.30	62
April 27	61	29	.51	72	February 23	6	10	1.97	43
April 28	61	28	.50	68	March 12	6	4.8	1.53	31
May 19	61	20	.37	34	March 21	6	3.6	1.12	20
May 29	61	23	.41	46	April 5	6	3.2	.91	17
June 11 [a]	53	15	.28	22	May 12	6	3.1	.73	11
June 16 [b]	57	16	.....	27	November 18	3	1.1	.....	1.6
June 20 [b]	28	10	1.08	19	December 22	6	2.7	.....	4.3

[a] By Clapp and Hardy. [b] By N. L. Hall.

Monthly discharge of Cottonwood Creek near Jamul, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	1,170	46	175	10,800	B.
February	116	36	66.9	3,720	B.
March	648	44	191	11,700	B.
April	306	64	111	4,600	B.
May	66	28	44.4	2,730	B.
June	49	9	23.2	1,380	B.
July	8.7	22	4.2	258	C.
August	2.5	.1	1.2	74	C.
September	2	.3	1.0	60	C.
October	16	2.2	7.5	461	C.
November	12	7.0	8.9	530	C.
December	12	7.6	9.8	603	C.
The year	1,170	.1	53.7	38,900	
1908.					
January	96	10	25.2	1,550	C.
February	155	28	58.4	3,360	C.
March	74	15	34.0	2,090	C.
April	31	10	15.6	928	C.
May	20	6.4	9.51	585	C.
June	6.6	.50	3.49	208	C.
July	.70	.02	.145	9	D.
August	.50	.05	.085	5	D.
September	.32	.07	.214	13	D.
October	6.3	.32	2.37	146	D.
November	5.0	3.6	4.31	256	C.
December	8.6	4.7	6.22	382	C.
The year	155	.02	13.3	9,530	

NOTE.—Discharges for the higher stages of 1907 were obtained by rating the Barrett dam as a weir. For intermediate stages the discharge for both years is based on a record of gage heights in a 6-foot flume through the dam, which was rated by measurements in 1907 and 1908. For the lowest stages of 1907 a quadrant weir was used.

PINE VALLEY CREEK NEAR JAMUL, CAL.

This station, which is located a short distance above the junction of Pine Valley Creek with Cottonwood Creek, was established in January, 1906, chiefly for the purpose of determining the relation between the flow of Pine Valley and Cottonwood creeks. The station was discontinued December 31, 1908.

Conditions for obtaining accurate discharge data are bad. On account of its isolated location only occasional gage readings were made during 1907 and none in 1908. All estimates of discharge are approximate only. No monthly discharges were computed for 1908.

Discharge measurements of Pine Valley Creek near Jamul, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 5	W. V. Hardy	32	11	4.45	27
January 15	do	45	22	4.60	55
February 7	do	45	14	4.30	31
February 27	do	47	17	4.30	39
March 8	do	46	26	4.58	90
March 20	do	47	19	4.32	38
April 11	do	47	21	4.35	51
April 27	do	46	15	4.20	30
May 19	do	25	9	3.95	17
May 29	do	35	9	3.90	13
June 11	Clapp and Hardy	14	5.8	3.75	14
June 16	N. L. Hall	23	6	3.77	10
December 16	W. V. Hardy	5	2	3.33	3.2
1908.					
January 16	W. V. Hardy	6	2.6	3.40	5.3
January 27	do	24	9	3.74	20
February 14	do	28	11	3.88	24
February 23	do	16	8.4	3.80	20
March 12	do	12	5.8	.....	13
March 21	do	6	4.2	.....	10
April 5	do	7	3.8	.....	7.2
May 12	do	6	2.6	.....	4.1
November 18	do	2	.80	.....	.91
December 22	do	4	1.6	.....	2.1

Monthly discharge of Pine Valley Creek near Jamul, Cal., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	124	19	49.3	3,030	C.
February	45	26	34.8	1,930	C.
March	119	36	62.4	3,840	C.
April	71	27	45.0	2,680	C.
May	30	12	19.8	1,220	C.
June	15	3	10.0	595	C.
July	3	1	2.0	123	D.
August	1.3	0	.6	37	D.
September	8	0	.3	18	D.
October	7	1.2	3.1	191	D.
November	3.5	2.8	3.0	179	D.
December	5.1	2.8	3.4	209	D.
The year	119	0	19.5	14,100	

NOTE.—Discharges from January to June, inclusive, were obtained by the indirect method for shifting channels. For the rest of the year discharges were interpolated by comparison with the discharge of Cottonwood Creek for the same dates.

SWEETWATER RIVER DRAINAGE BASIN.

DESCRIPTION.

Sweetwater River rises in the south and east slope of the Cuyamaca Mountains of the Coast Range, flows nearly due south for a distance of 15 miles, then turns to the west and southwest and discharges into San Diego Bay south of National City. Its length is 45 miles and its area comprises approximately 215 square miles, the greater part of which is in mountainous country. The basin is extremely narrow. It lies directly south of San Diego River and north of the Otay River and Cottonwood Creek basins.

The topography is not as rough as that of San Diego River basin, although the mountains and foothills extend to within 3 or 4 miles of the shore line of San Diego Bay, and the valley and mesa lands are not so extensive as along San Diego River. The basin is poorly forested. The timber is confined almost entirely to the immediate valleys of the streams and to the higher mountain areas. The mountain slopes have a fairly good covering of brush, but the lower foothills are almost bare, supporting only a sparse growth of low brush.

The mean annual rainfall varies from 10 to 15 feet along the foothill belt and from 20 to 40 inches in the mountains.

A considerable area lying between San Diego Bay and the foothills south from National City to the Mexican boundary is under a high state of cultivation. The greater part of this land is irrigated by water taken from Sweetwater River.

The celebrated Sweetwater masonry dam is located on Sweetwater River about 8 miles above its mouth at an elevation of 145 feet. There are two other reservoir sites on Sweetwater River, one a short distance above the Dehesa post-office and another 1 mile below Descanso, at an elevation of 3,340 feet above sea level.

During the extremely dry period from 1898 to 1904 there were years when no waters from Sweetwater River reached the reservoir. From 1899 to 1904 the reservoir was dry, and to tide over this period of drought pumping was resorted to. Wells were sunk in the reservoir site and pumps installed, by means of which water was delivered to the distribution system. Pumping operations were also extensively carried on in the valley along the river below the reservoir. It is probable that the construction of additional storage reservoirs on the upper reaches of the river would serve to tide over an extended dry period.

The following record of run-off has been kept at the Sweetwater reservoir by the San Diego Land and Town Company:

Estimated annual run-off at Sweetwater reservoir.

[Drainage area, 186 square miles.]

Year ending June 30—	Rainfall (inches).[a]	Run-off.		
		Total in acre-feet.	Acre-feet per square mile.	Depth in inches on drainage area.
1888	16.00	7,048	37.9	0.71
1889	33.55	25,253	135.7	2.57
1890	38.65	20,532	110.4	2.07
1891	37.92	21,565	115.9	2.16
1892	24.58	6,198	33.3	.62
1893	26.16	16,261	87.4	1.63
1894	10.12	1,338	7.2	.13
1895	35.23	73,412	395.0	7.38
1896	16.41	1,321	7.1	.13
1897	23.88	6,891	37.0	.69
1898	18.03	4	.0	.00
1899	13.56	245	1.3	.02
1900	16.13	0	.0	.00
1901	24.82	861	4.6	.08
1902	20.25	0	.0	.00
1903	20.77	0	.0	.00
1904	14.94	0	.0	.00
1905	35.95	11,730	63.1	1.19
Mean, 18 years	23.72	10,703	57.5	1.07

[a] Taken as mean between Sweetwater dam and Cuyamaca.

The only gaging station maintained in this basin is on Sweetwater River near Descanso, 1906 to 1908.

SWEETWATER RIVER NEAR DESCANSO, CAL.

This station, which is located at the Ellis ranch, 1½ miles below Descanso post-office, near the east line of T. 17 S., R. 3 E., San Bernardino meridian, was established December 9, 1905, to determine the amount of water available for storage at the Guatay reservoir site and to ascertain the run-off in the upper reaches of the basin.

Measurements are made from a cable during high water and by wading during low and medium stages.

Guatay Creek enters the river from the east about 2 miles above the gaging station. A small diversion amounting only to a fraction of a second-foot is made above the gaging station for irrigation on the Ellis ranch. No change has been made in the datum of the gage.

Discharge measurements of Sweetwater River near Descanso, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	17	5.8	3.58	9.6
January 12	19	15	4.00	49
January 13	19	14	4.10	49
February 6	19	10	4.00	26
February 9	19	10	3.90	22
February 25	28	12	4.12	27
February 28	20	9	4.08	25
March 7	22	22	4.80	95
March 19	34	15	4.20	43
April 9	31	16	4.30	49
April 25	28	12	4.10	26
May 18	18	10	3.82	18
May 30	18	9	3.68	15
June 14	16	6.4	3.52	11
June 23	6	2	3.30	2.5
July 23 [a]	6	2	3.30	2.5
December 15	3	1.8	3.29	4.7
December 31	4	1.6	3.27	3.3
1908.				
January 15	10	4.2	3.41	5.9
January 26	10	6	3.50	10
January 27	10	5.2	3.41	7.9
January 28	15	7.8	3.60	13
February 11	12	7.8	3.50	12
February 11	14	8.2	3.52	12
February 11	14	9.8	3.60	17
February 12	17	16	3.82	36
February 22	14	6.4	3.49	9.8
February 24	14	7.8	3.50	12
March 3	16	6.2	3.52	9.4
March 4	16	8.4	3.73	18
March 11	16	5.6	3.50	9.1
March 20	16	3.4	3.42	4.2
March 22	16	3.4	3.43	4.3
April 3	16	3.8	3.44	4.7
April 13	16	3.2	3.44	3.7
April 28	10	3.0	3.33	4.0
May 7	10	3.6	3.32	4.9
May 13	10	3.6	3.32	5.0
May 27	6	1.6	3.16	1.8
June 13	5	1.2	3.1	1.1
July 7	2	.4	2.98	.36
November 16	2.5	1.0	3.11	.78
December 8	3	1.3	3.21	1.5
December 19	4	1.2	3.21	1.4

[a] By W. A. Lamb.

Daily gage height, in feet, of Sweetwater River near Descanso, Cal., for 1907 and 1908.

[Charles H. Ellis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.55	4.1	4.05	.....	4.0	3.65	3.38	3.26	3.24	3.25	3.25	3.2
2	3.6	4.1	4.0	4.35	4.0	3.65	3.38	3.26	3.24	3.25	3.25	3.2
3	3.55	4.1	4.0	4.8	4.0	3.6	3.38	3.26	3.24	3.25	3.25	3.25
4	3.6	4.05	4.05	4.4	4.0	3.6	3.38	3.26	3.24	3.25	3.2	3.25
5	3.6	4.0	5.1	4.4	4.05	3.65	3.36	3.26	3.24	3.25	3.2	3.25
6	3.75	4.0	4.85	4.3	4.05	3.7	3.35	3.26	3.24	3.3	3.2	3.4
7	3.8	3.95	4.8	4.3	4.0	3.7	3.35	3.28	3.24	3.3	3.2	3.35
8	3.8	3.9	4.85	4.3	3.95	3.7	3.35	.....	3.23	3.25	3.2	3.3
9	3.9	3.95	4.7	4.3	3.95	3.65	3.36	.....	3.23	3.25	3.2	3.3
10	4.9	3.9	4.65	4.3	3.95	3.6	3.38	.....	3.23	3.25	3.2	3.4
11	4.15	3.85	4.65	4.25	4.0	3.55	3.38	3.25	3.23	3.25	3.2	3.35
12	4.0	3.85	4.6	4.25	3.95	3.6	3.37	3.25	3.23	3.25	3.2	3.3
13	4.1	3.85	4.5	4.2	3.9	3.65	3.37	3.25	3.23	3.25	3.2	3.3
14	4.45	3.85	4.45	4.2	3.9	3.55	3.37	3.25	3.23	3.6	3.25	3.3
15	4.25	3.85	4.4	4.2	3.9	3.5	3.37	3.25	3.23	3.5	3.25	3.3

Daily gage height, in feet, of Sweetwater River near Descanso, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	4.1	4.5	4.4	4.2	3.85	3.45	3.37	3.24	3.23	3.35	3.25	3.3
17	4.2	4.1	4.25	4.2	3.85	3.45	3.37	3.24	3.23	3.35	3.25	3.3
18	5.05	4.1	4.2	4.2	3.8	3.45	3.37	3.24	3.23	3.3	3.25	3.3
19	4.8	4.05	4.2	4.15	3.8	3.45	3.36	3.24	3.23	3.3	3.25	3.3
20	4.8	4.1	4.3	4.1	3.8	3.45	3.32	3.24	3.23	3.3	3.25	3.25
21	4.7	4.1	4.4	4.05	3.75	3.45	3.32	3.24	3.23	3.3	3.25	3.25
22	4.7	4.4	4.3	4.05	3.75	3.45	3.3	3.22	3.23	3.35	3.25	3.25
23	4.6	4.2	4.25	4.05	3.75	3.45	3.28	3.22	3.23	3.45	3.25	3.25
24	4.5	4.15	4.3	4.1	3.75	3.45	3.28	3.22	3.23	3.45	3.25	3.25
25	4.35	4.15	4.65	4.1	3.75	3.4	3.28	3.22	3.23	3.4	3.25	3.25
26	4.2	4.1	4.9	4.1	3.75	3.4	3.29	3.22	3.23	3.35	3.25	3.25
27	4.1	4.1	4.95	4.05	3.75	3.4	3.29	3.23	3.23	3.35	3.25	3.25
28	4.1	4.05	4.55	4.05	3.75	3.4	3.29	3.24	3.23	3.3	3.25	3.3
29	4.1	.....	4.5	4.05	3.7	3.4	3.28	3.24	3.23	3.3	3.25	3.3
30	4.5	.....	.....	4.0	3.7	3.4	3.28	3.24	3.23	3.25	3.2	3.3
31	4.25	.....	.....	.....	3.7	.....	3.27	3.24	.....	3.25	.....	3.3
1908.												
1	3.25	3.45	3.55	3.5	3.25	3.15	3.05	3.0	3.1	3.1	3.1	3.1
2	3.25	3.4	3.5	3.45	3.4	3.15	.....	3.0	.....	3.1	3.1	3.15
3	3.25	3.9	3.5	3.45	3.5	3.15	.....	3.0	.....	3.1	3.1	3.2
4	3.25	3.8	3.8	3.45	3.35	3.15	.....	3.0	.....	3.1	3.1	3.2
5	3.25	3.6	3.85	3.45	3.3	3.15	.....	3.0	.....	3.1	3.1	.....
6	3.25	3.5	3.8	3.45	3.3	3.15	.....	.....	3.1	3.1	3.1	.....
7	3.25	3.4	3.7	3.5	3.3	3.15	3.0	.....	.....	3.1	3.1	.....
8	3.25	3.4	3.6	3.5	3.3	3.15	3.0	.....	.....	3.1	3.1	3.2
9	3.25	3.6	3.55	3.45	3.3	3.1	3.0	.....	.....	3.1	3.1	3.2
10	3.25	3.6	3.5	3.45	3.3	3.1	3.0	3.0	3.7	3.1	3.1	3.2
11	3.2	3.6	3.5	3.45	3.3	3.1	3.0	.....	.....	3.1	3.1	3.2
12	3.2	3.7	3.45	3.45	3.35	3.1	3.0	.....	.....	3.1	3.1	3.2
13	3.25	3.6	3.45	3.45	3.3	3.1	3.0	.....	.....	3.1	3.1	3.2
14	3.5	3.55	3.45	3.45	3.3	3.1	3.0	.....	.....	3.1	3.1	3.2
15	3.4	3.55	3.45	3.4	3.25	3.1	3.0	.....	.....	3.15	3.1	3.2
16	3.3	3.55	3.45	3.4	3.25	3.1	3.0	.....	.....	3.2	3.1	3.25
17	3.25	3.55	3.45	3.35	3.25	3.1	3.0	3.05	.....	3.15	3.1	3.25
18	3.25	3.5	3.45	3.35	3.25	3.1	3.0	.....	.....	3.15	3.1	3.2
19	3.25	3.5	3.45	3.3	3.25	3.1	3.0	.....	.....	3.15	3.1	3.2
20	3.25	3.5	3.45	3.3	3.2	3.1	3.0	.....	.....	3.1	3.1	3.2
21	3.25	3.5	3.45	3.3	3.2	3.1	3.0	.....	.....	3.1	3.1	3.2
22	3.25	3.5	3.45	3.65	3.2	3.05	3.0	.....	.....	3.1	.....	3.2
23	3.4	3.5	3.45	3.65	3.2	3.05	3.0	.....	3.15	3.1	.....	3.2
24	3.45	3.5	3.45	3.55	3.2	3.05	3.0	3.05	3.2	3.1	.....	3.2
25	3.55	.....	3.5	3.45	3.2	3.05	3.0	.....	.....	3.1	.....	3.2
26	3.5	.....	3.75	3.4	3.2	3.05	3.0	.....	.....	3.1	3.15	3.2
27	3.45	3.4	3.7	3.4	3.2	3.05	3.0	.....	.....	3.1	3.15	3.2
28	3.6	3.45	3.6	3.3	3.15	3.05	3.0	.....	.....	3.1	3.15	3.2
29	3.55	3.6	3.6	3.25	3.15	3.05	3.0	.....	.....	3.1	3.15	3.2
30	3.45	.....	3.55	3.25	3.15	3.05	3.0	.....	.....	3.1	3.1	3.2
31	3.45	.....	3.5	.....	3.15	.....	3.0	3.1	.....	3.1	.....	3.2

Monthly discharge of Sweetwater River near Descanso, Cal., for 1907 and 1908.

[Drainage area, 40 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	134	9	56.7	1.42	1.64	3,490	B.
February	63	18	28.6	.715	.74	1,590	B.
March	123	24	65.0	1.62	1.87	4,000	B.
April	95	23	39.8	.995	1.11	2,370	B.
May	26	15	19.6	.490	.56	1,210	B.
June	15	6.5	9.8	.245	.27	583	B.
July	6.0	3.4	5.0	.125	.14	307	B.
August	3.7	2.3	2.9	.072	.08	178	B.
September	2.8	2.6	2.6	.065	.07	155	B.
October	12	3.0	4.5	.112	.13	277	B.
November	3.0	1.9	2.6	.065	.07	155	B.
December	6.5	1.9	3.8	.095	.11	234	B.
The year	134	1.9	20.1	.502	6.79	14,500	
1908.							
January	13	2.0	4.9	.122	.14	301	C.
February	34	6.0	13.8	.345	.37	794	C.
March	26	5.0	10.2	.255	.29	627	C.
April	16	3.0	5.4	.135	.15	321	C.
May	11	1.5	3.6	.090	.10	221	C.
June	1.5	.5	1.0	.025	.03	60	C.
July	.4	.4	.4	.010	.01	25	C.
August	1.0	.4	.5	.012	.01	31	C.
September	20	1.0	1.8	.045	.05	107	C.
October	2.0	1.0	1.0	.025	.03	61	C.
November	1.0	1.0	1.0	.025	.03	60	C.
December	1.5	1.0	1.5	.038	.04	92	C.
The year	34	.4	3.8	.094	1.25	2,700	

NOTE.—Discharges were obtained by the indirect method for shifting channels from January 1 to May 18, 1907. A rating table was used for remainder of year.

Daily discharges for 1908 were obtained by the indirect method for shifting channels.

SAN DIEGO RIVER DRAINAGE BASIN.

DESCRIPTION.

San Diego River rises in the Cuyamaca Mountains on the western slope of the Coast Range and flows in a southwesterly direction, discharging into Pacific Ocean through False Bay at the northern boundary of San Diego City. Its length is about 50 miles, half of which lies in the mountains above the town of Lakeside. The San Diego basin lies directly south of the Santa Ysabel basin and north of Sweetwater River basin.

The San Diego has several small tributaries, the most important being Coleman, Cedar, Boulder, South Fork, and Chocolate creeks, all of which enter from the east and south above Lakeside. San Vicente Creek, the only important tributary from the north, enters the river at Lakeside.

The upper part of the basin above Lakeside is extremely rough and rugged, but below Lakeside are numerous valleys and high mesa lands extending to the coast. Elevations throughout the basin range

from 50 to 600 feet in the foothills and from 600 to 6,000 feet in the mountains. Cuyamaca Peak, the highest point in the basin, has an elevation of 6,028 feet. The formation is the loose granite that is typical of all river basins in San Diego County.

The San Diego basin is very poorly forested. The timber is confined almost entirely to the valley along the streams and to the higher mountain areas. The mountain slopes have a fairly good covering of brush, but the lower foothills are almost entirely bare, having only a scattering growth of low brush.

The mean annual rainfall varies from 10 to 15 inches along the foothill belt, and from 20 to 40 inches in the mountains.

Irrigation is carried on extensively in the valleys and on the mesa lands between Lakeside and San Diego, and additional areas might be irrigated if an adequate supply of water could be assured. Two storage reservoirs have been constructed: The Cuyamaca reservoir is situated on Boulder Creek, at an elevation of 4,600 feet above sea level, and has a capacity of 11,400 acre-feet with a 35-foot earthen dam. La Mesa reservoir is located in the foothills about 2 miles northwest of the town of La Mesa, at an elevation of 435 feet. The dam is of earth and rock, is 66 feet high, and has a storage capacity of about 1,500 acre-feet. La Mesa reservoir is filled by water diverted from San Diego River during the winter months.

The practicability of future development in this basin can be determined only by continuing stream-flow observations.

The only gaging station maintained in this basin is on the San Diego River near Lakeside, 1906 to 1908.

SAN DIEGO RIVER AND SAN DIEGO FLUME NEAR LAKESIDE, CAL.

This station, which is located about 1 mile above the railway station, at crossing of road from Lakeside to Padre Barona Valley, was established in December, 1905, to determine the amount of water available for further irrigation development.

Chocolate Creek enters the river from the south 7 miles above, and San Vicente Creek from the north 1 mile below the gaging station. The drainage area at this point is 208 square miles.

The San Diego flume diverts water from the river at a point one-half mile below the junction of Boulder Creek and about 15 miles above the gaging station. This flume diverts all the low flow of the river and a sufficient amount of the winter flow to fill La Mesa storage reservoir. The present capacity of the flume is about 16 second-feet. A daily record of the depth of water in the flume is kept by the San Diego Flume Company at the trestle crossing at Los Coches Creek, 3½ miles southeast of Lakeside, and has been furnished the United States Geological Survey. Discharge measurements have been made

in the flume at this point, and estimated daily discharge is shown in addition to that of the river at Lakeside.

The conditions at the gaging station are extremely bad for procuring accurate estimates of discharge. The channel is wide and is composed of sand, which is constantly shifting and changing the position of the stream. Many measurements are necessary to procure reliable estimates of discharge. Results obtained at this station are approximate only. No change has been made in the datum of the gage.

Discharge measurements of San Diego River near Lakeside, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 3	52	23	3.65	39	January 3	4	1.2	3.20	1.0
January 8	54	29	3.80	82	January 11	4	1.2	3.22	1.2
January 10	57	61	4.10	234	January 18	4	1.2	3.23	1.4
January 18	62	135	4.60	667	January 24	21	8.4	3.36	13
January 19	57	74	4.20	419	January 24	21	12	3.40	23
January 20	57	61	4.00	303	January 25	30	16	3.50	30
February 4	57	42	3.75	105	January 28	55	42	3.60	105
February 11	57	33	3.60	74	February 10	62	52	3.80	133
February 23	59	49	3.90	152	February 15	53	38	3.60	84
March 4	59	33	3.62	81	February 22	53	23	3.50	44
March 5	63	72	4.15	335	February 26	45	22	3.45	39
March 5	63	96	4.35	623	March 3	56	24	3.50	40
March 5	66	98	4.50	576	March 4	61	32	3.60	62
March 11	61	56	3.85	187	March 5	63	46	3.80	132
March 18	60	45	3.75	116	March 13	62	20	3.48	30
March 23	63	77	3.95	268	March 20	48	16	3.45	26
April 1	63	64	3.90	189	March 25	35	10	3.38	14
April 13	60	46	3.80	145	April 1	41	15	3.41	19
April 24	60	38	3.65	91	April 6	41	13	3.40	17
May 3	60	29	3.60	62	April 12	21	4.5	3.34	4.5
May 17	48	23	3.54	33	April 17	8	3.2	3.35	3.9
May 25	48	18	3.48	26	April 25	27	13	3.45	21
May 31	42	14	3.49	20	April 28	14	4.3	3.31	4.8
June 8	40	14	3.50	23	May 5	38	12	3.45	16
June 13	43	19	3.52	30	May 13	18	4.1	3.38	5.2
July 22 [a]	3	.68	3.30	.62	May 26	2	.5	3.27	.5
December 14	2	.6	3.16	.57	July 7	.....	.....	3.26	.2
December 19	3	.9	3.18	.66					
December 30	4	1.2	3.20	1.10					

[a] Made by W. A. Lamb.

Daily gage height, in feet, of San Diego River near Lakeside, Cal., for 1907 and 1908.

[J. H. Lucas and J. H. Beadle, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.8	3.95	3.65	3.95	3.65	3.5	3.30	.....	.....	.....	.....	3.1
2	3.85	3.8	3.65	4.0	3.6	3.5	3.28	.....	.....	.....	.....	3.1
3	3.65	3.75	3.6	4.1	3.6	3.5	3.27	.....	.....	.....	.....	3.1
4	3.6	3.75	3.6	4.0	3.6	3.5	3.28	.....	.....	.....	.....	3.1
5	3.6	3.7	4.4	4.0	3.65	3.5	3.26	.....	.....	.....	.....	3.1
6	3.95	3.7	4.1	4.0	3.65	3.5	3.28	.....	.....	.....	.....	3.1
7	3.9	3.65	4.1	3.95	3.7	3.5	3.3	.....	.....	.....	.....	3.15
8	3.8	3.6	4.1	3.9	3.65	3.55	3.3	.....	.....	.....	.....	3.15
9	3.8	3.6	4.0	3.9	3.6	3.5	3.28	.....	.....	.....	.....	3.15
10	4.1	3.6	3.9	3.85	3.6	3.5	3.27	.....	.....	.....	3.15	3.10
11	4.4	3.55	3.85	3.85	3.6	3.5	3.26	.....	.....	.....	3.1	3.15
12	3.95	3.5	3.9	3.85	3.6	3.5	3.28	.....	.....	.....	3.1	3.15
13	3.8	3.5	3.9	3.8	3.6	3.5	3.28	.....	.....	.....	3.1	3.15
14	3.9	3.55	3.8	3.75	3.6	3.5	3.28	.....	.....	.....	3.05	3.15
15	4.0	3.5	3.8	3.75	3.55	3.45	3.28	.....	.....	.....	3.05	3.15

Daily gage height, in feet, of San Diego River near Lakeside, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.95	3.55	3.85	3.8	3.55	3.45	3.28	.....	.....	.....	3.05	3.15
17	3.95	4.0	3.8	3.8	3.55	3.45	3.29	.....	.....	.....	3.1	3.15
18	5.0	3.8	3.7	3.75	3.5	3.4	3.3	.....	.....	.....	3.1	3.15
19	4.2	3.75	3.75	3.7	3.5	3.4	3.29	.....	.....	.....	3.1	3.2
20	4.0	3.7	3.7	3.7	3.5	3.4	3.29	.....	.....	.....	3.1	3.15
21	4.0	3.65	4.0	3.7	3.5	3.4	3.3	.....	.....	.....	3.1	3.15
22	3.95	3.7	3.95	3.7	3.5	3.4	3.29	.....	.....	.....	3.1	3.15
23	3.9	3.7	3.9	3.65	3.5	3.4	3.28	.....	.....	.....	3.1	3.15
24	3.8	3.65	3.85	3.65	3.5	3.4	3.3	.....	.....	.....	3.1	3.2
25	3.8	3.6	3.8	3.7	3.5	3.4	3.3	.....	.....	.....	3.1	3.2
26	3.75	3.7	4.8	3.65	3.5	3.35	3.28	.....	.....	.....	3.1	3.2
27	3.7	3.7	4.4	3.7	3.5	3.35	3.29	.....	.....	.....	3.1	3.2
28	3.7	3.65	4.1	3.6	3.5	3.3	3.29	.....	.....	.....	3.1	3.2
29	3.7	.....	3.95	3.65	3.5	3.3	3.28	.....	.....	.....	3.1	3.2
30	3.8	.....	3.9	3.7	3.5	3.3	3.28	.....	.....	.....	3.1	3.2
31	3.7	.....	3.95	.....	3.5	.....	3.27	.....	.....	.....	.....	3.2
1908.												
1	3.2	3.3	3.6	3.45	3.3	3.3	3.3	.....	.....	.....	.....	.....
2	3.2	3.3	3.5	3.45	3.3	3.3	3.3	.....	.....	.....	.....	.....
3	3.2	3.65	3.5	3.4	3.35	3.3	3.3	.....	.....	.....	.....	.....
4	3.2	4.25	3.55	3.4	3.5	3.3	3.25	.....	.....	.....	.....	.....
5	3.2	3.7	3.8	3.4	3.45	3.3	3.25	.....	.....	.....	.....	.....
6	3.2	3.5	3.75	3.4	3.4	3.3	3.25	.....	.....	.....	.....	.....
7	3.2	3.5	3.65	3.4	3.35	3.3	3.25	.....	.....	.....	.....	.....
8	3.2	3.4	3.6	3.4	3.35	3.3	3.25	.....	.....	.....	.....	.....
9	3.2	3.45	3.6	3.4	3.3	3.3	3.25	.....	.....	.....	.....	.....
10	3.2	4.0	3.55	3.4	3.3	3.3	3.25	.....	.....	.....	.....	.....
11	3.2	3.85	3.5	3.4	3.3	3.3	3.25	.....	.....	.....	.....	.....
12	3.2	3.8	3.5	3.4	3.3	3.3	3.25	.....	.....	.....	.....	.....
13	3.2	3.9	3.5	3.35	3.35	3.3	3.25	.....	.....	.....	.....	.....
14	3.2	3.7	3.45	3.35	3.4	3.3	3.25	.....	.....	.....	.....	.....
15	3.35	3.6	3.45	3.35	3.35	3.3	3.25	.....	.....	.....	.....	.....
16	3.4	3.6	3.45	3.3	3.3	3.3	3.25	.....	.....	.....	.....	.....
17	3.4	3.6	3.45	3.35	3.3	3.3	3.25	.....	.....	.....	.....	3.2
18	3.2	3.5	3.45	3.35	3.3	3.3	3.2	.....	.....	.....	.....	3.2
19	3.2	3.5	3.45	3.35	3.3	3.3	3.2	.....	.....	.....	.....	3.2
20	3.2	3.5	3.45	3.3	3.3	3.3	3.2	.....	.....	.....	.....	3.2
21	3.2	3.5	3.45	3.3	3.3	3.3	3.1	.....	.....	.....	.....	3.25
22	3.2	3.5	3.4	3.35	3.3	3.3	3.1	.....	.....	.....	.....	3.25
23	3.25	3.55	3.4	3.5	3.3	3.3	3.1	.....	.....	.....	.....	3.25
24	3.4	3.5	3.35	3.5	3.3	3.3	3.1	.....	.....	.....	.....	3.25
25	3.5	3.5	3.4	3.45	3.3	3.3	3.1	.....	.....	.....	.....	3.25
26	3.6	3.45	3.6	3.4	3.3	3.3	3.0	.....	.....	.....	.....	3.25
27	3.45	3.4	3.7	3.4	3.3	3.3	.....	.....	.....	.....	.....	3.25
28	3.45	3.4	3.6	3.35	3.3	3.3	.....	.....	.....	.....	.....	3.25
29	3.6	3.45	3.5	3.3	3.3	3.3	.....	.....	.....	.....	.....	3.25
30	3.5	.....	3.45	3.3	3.3	3.3	.....	.....	.....	.....	.....	3.25
31	3.4	.....	3.45	.....	3.3	3.3	.....	.....	.....	.....	.....	3.25

NOTE.—River dry August 1 to November 9, 1907, and July 27 to December 16, 1908.

Monthly discharge of San Diego River near Lakeside, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	1,050	27	183	11,300	C.
February	260	32	87.6	4,870	C.
March	940	60	242	14,900	C.
April	320	68	157	9,340	C.
May	83	23	45.4	2,790	C.
June	23	.6	15	893	D.
July	.6	.2	.44	27	D.
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	.5	.1	.2	12	D.
December	1	.3	.6	37	D.
The year	1,050	0	60.9	44,200	
1908.					
January	100	1	15.5	953	C.
February	300	14	76	4,370	C.
March	130	12	44	2,700	C.
April	30	4	11.6	690	C.
May	25	.5	5	307	C.
June	.5	.2	.4	24	D.
July	.2	0	.1	6	D.
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	0	0	0	0	
December	.2	0	.1	6	D.
The year	300	0	12.7	9,060	

NOTE.—Daily discharges were obtained by the indirect method for shifting channels. The above estimate does not include the water diverted by the San Diego Flume Company above the station.

Discharge measurements of San Diego flume near Lakeside, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 27	W. V. Hardy	5.9	3.9	0.66	9.6
November 13	do	5.9	3.0	.50	5.8
December 6	do	5.9	1.6	.27	1.8
December 18	do	5.9	1.6	.27	1.8

Daily gage height, in feet, of San Diego flume near Lakeside, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.64	0.21	0.33	0.54	0.71	0.88	0.62	0.65	0.67	0.61	0.43	0.50
2	.65	.17	.32	.55	.71	.78	.64	.62	.60	.61	.38	.30
3	.75	.17	.31	.52	.71	.70	.69	.60	.54	.64	.43	.42
4	.67	.17	.49	.53	.74	.67	.71	.57	.57	.61	.42	.32
5	.58	.24	.43	.53	.67	.53	.70	.57	.67	.59	.41	.52
6	.56	.22	.41	.50	.62	.55	.70	.58	.65	.58	.36	.31
7	.55	.21	.41	.52	.62	.55	.70	.56	.64	.60	.40	.56
8	.67	.23	.31	.52	.62	.61	.71	.55	.59	.57	.44	.55
9	.47	.24	.31	.50	.62	.65	.69	.52	.60	.52	.44	.25
10	.43	.23	.31	.50	.62	.60	.66	.55	.66	.54	.30	.15
11	.29	.24	.30	.50	.73	.62	.66	.61	.66	.54	.44	.18
12	.38	.24	.32	.58	.79	.65	.61	.62	.67	.53	.42	.24
13	.44	.39	.34	.58	.76	.73	.60	.66	.67	.51	.39	.15
14	.49	.47	.35	.55	.69	.88	.60	.65	.68	.52	.28	.16
15	.35	.46	.33	.54	.67	.60	.66	.65	.68	.64	.08	.38

Daily gage height, in feet, of San Diego flume near Lakeside, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	0.36	0.50	0.33	0.53	0.67	0.55	0.69	0.81	0.66	0.61	0.18	0.11
17	.38	.49	.33	.52	.66	.60	.69	.67	.67	.55	.25	.08
18	.25	.47	.35	.51	.67	.64	.66	.66	.67	.48	.12	.03
19	.27	.40	.33	.50	.67	.62	.62	.66	.68	.47	.21	.02
20	.30	.27	.35	.50	.65	.60	.65	67	.68	.49	.00	.26
21	.32	.27	.41	.50	.67	.64	.66	.69	.64	.39	.00	.29
22	.35	.30	.40	.65	.69	.67	.65	.65	.49	.46	.00	.41
23	.31	.27	.38	.71	.72	.65	.65	.60	.51	.55	.10	.25
24	.33	.44	.44	.71	.81	.65	.65	.58	.67	.49	.51	.25
25	.23	.54	.38	.71	.82	.62	.65	.57	.67	.52	.54	.38
26	.22	.52	.32	.71	.83	.64	.67	.59	.67	.54	.54	.00
27	.26	.45	.36	.71	.84	.64	.67	.65	.66	.51	.55	.24
28	.27	.33	.38	.71	.85	.62	.68	.66	.67	.52	.29	.38
29	.51	.....	.38	.71	.88	.61	.65	.65	.62	.53	.42	.50
30	.42	.....	.36	.71	.88	.62	.64	.67	.64	.34	.33	.64
31	.23	.....	.48	.....	.88	.....	.65	.68	.....	.36	.....	.34
1908.												
1	.43	.71	.34	.44	.71	.59	.57	.62	.58	.55	.50	.47
2	.42	.71	.34	.45	.76	.53	.58	.62	.54	.59	.48	.44
3	.40	.79	.36	.45	.76	.53	.58	.64	.56	.59	.45	.33
4	.40	.49	.33	.55	.74	.52	.56	.60	.60	.57	.46	.10
5	.40	.56	.28	.53	.72	.51	.53	.56	.58	.56	.48	.27
6	.39	.58	.27	.53	.71	.52	.54	.58	.52	.54	.47	24
7	.31	.60	.27	.55	.70	.50	.54	.51	.50	.52	.44	.34
8	.29	.62	.27	.62	.69	.50	.56	.54	.51	.51	.42	.48
9	.30	.62	.26	.64	.68	.50	.59	.58	.56	.50	.43	.48
10	.30	.50	.26	.62	.68	.50	.60	.58	.58	.58	.45	.44
11	.40	.49	.31	.62	.68	.55	.61	.41	.52	.54	.51	.42
12	.42	.48	.43	.71	.71	.60	.59	.26	.52	.54	.51	.36
13	.50	.54	.43	.71	.73	.58	.59	.35	.46	.57	.50	.32
14	.50	.31	.43	.71	.70	.53	.60	.57	.51	.57	.49	.33
15	.48	.28	.42	.69	.68	.52	.60	.58	.56	.57	.49	.33
16	.49	.40	.41	.69	.66	.54	.61	.49	.60	.59	.49	.32
17	.54	.60	.41	.69	.65	.55	.62	.54	.61	.58	.48	.38
18	.52	.00	.42	.68	.61	.57	.58	.56	.61	.53	.50	.38
19	.46	.00	.42	.65	.57	.57	.55	.57	.62	.44	.52	.33
20	.48	.48	.45	.66	.51	.57	.50	.59	.55	.47	.50	.28
21	.55	.48	.41	.69	.57	.55	.50	.58	.54	.54	.45	.25
22	.57	.48	.42	.72	.53	.55	.59	.58	.52	.53	.45	.24
23	.60	.48	.41	.64	.54	.56	.60	.57	.61	.51	.47	.23
24	.66	.48	.40	.69	.49	.54	.58	.56	.66	.52	.48	.23
25	.71	.48	.39	.72	.50	.55	.59	.57	.52	.49	.32	.21
26	.71	.48	.45	.71	.58	.55	.42	.60	.64	.49	.33	.17
27	.71	.49	.46	.69	.61	.57	.54	.59	.64	.51	.47	.17
28	.71	.46	.39	.69	.61	.58	.56	.59	.64	.52	.48	.18
29	.68	.36	.41	.71	.58	.58	.55	.59	.62	.55	.49	.27
30	.71	.....	.45	.70	.58	.57	.56	.59	.59	.56	.48	.29
31	.73	.....	.45	.....	.59	.....	.61	.60	.....	.55	.....	.38

NOTE.—These gage-height records are kept by the San Diego Flume Company. Daily readings are made at 6.30 a. m., 12 m., and 5.30 p. m. in inches and have been reduced to feet.

Rating table for San Diego flume near Lakeside, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	0.00	0.25	1.66	0.50	5.90	0.75	12.22
.05	.12	.30	2.30	.55	7.02	.80	13.70
.10	.30	.35	3.05	.60	8.20	.85	15.20
.15	.64	.40	3.90	.65	9.47	.90	16.70
.20	1.10	.45	4.85	.70	10.80		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1908 and 1909 and is well defined.

Monthly discharge of San Diego flume near Lakeside, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Accuracy.
1907.				1908.			
January	4.62	284	A.	January	6.38	392	A.
February	2.97	165	A.	February	6.02	326	A.
March	3.31	204	A.	March	3.58	220	A.
April	7.79	464	A.	April	9.27	552	A.
May	11.58	712	A.	May	9.29	571	A.
June	9.44	562	A.	June	6.94	413	A.
July	9.76	600	A.	July	7.95	489	A.
August	8.91	548	A.	August	7.20	443	A.
September	9.20	547	A.	September	7.50	446	A.
October	6.63	408	A.	October	6.76	416	A.
November	3.16	188	A.	November	5.22	311	A.
December	2.79	172	A.	December	2.65	163	A.
The year	6.68	4,854		The year	5.79	4,742	

NOTE.—This water is diverted from San Diego River. The discharge should be added to that at the Lakeside station for the total flow of the river.

BERNARDO RIVER DRAINAGE BASIN.

DESCRIPTION.

Bernardo River, or Santa Ysabel Creek, as it is known from its source to the San Pasqual Valley, rises in the Volcan Mountains on the western slope of the Coast Range and flows westward through San Pasqual Valley, below which it takes its true name, and empties into the Pacific Ocean midway between Oceanside and San Diego. Its length is 50 miles, and the maximum width of the drainage basin about 15 miles. The total drainage area is approximately 340 square miles. It lies south of San Luis Rey River and north of the San Diego River basin.

Numerous small tributaries enter Santa Ysabel Creek from its source to San Pasqual Valley, the most important being Black Canyon and Temescal creeks from the north and Santa Maria Creek from the south. Above the San Pasqual Valley the creek maintains a light flow throughout the year, but below that point the channel is dry during the summer months.

The upper part of the basin is rough, the surface being cut by many canyons. The lower part in the foothills is more rolling, with large areas of valley and high mesa land. The formation is a loose granite. The basin has very little timber, the principal cover being brush, grass, and a few scattered oaks.

The mean annual rainfall varies from 10 to 15 inches along the foothills and from 20 to 40 inches in the mountains.

No important amount of irrigation is carried on in this basin. A diversion is made in San Pasqual Valley to irrigate a small area along the river.

A good storage reservoir site exists on the main stream at Pamo Valley, below the junction of Temescal Creek with the Santa Ysabel. The dam site is about 4 miles above the gaging station.

No great amount of water power can be developed in this basin.

The only gaging station maintained in this basin is on Santa Ysabel Creek at the east or upper end of San Pasqual Valley.

SANTA YSABEL CREEK NEAR ESCONDIDO, CAL.

This station, which is located below the mouth of the narrow canyon at the upper end of the San Pasqual Valley, in sec. 31, T. 12 S., R. 1 E., San Bernardino meridian, was established in December, 1905, to determine the quantity of water available for storage.

Roden Canyon Creek and Temescal Creek, tributaries from the north, enter the Santa Ysabel 1½ and 5 miles, respectively, above the gaging station. Santa Maria Creek enters from the south 4 miles below the gaging station.

No diversions are made from the creek above the gaging station. A small diversion is made below the station for irrigation in San Pasqual Valley.

Measurements are made from a cable at high water and by wading at medium and low stages. The conditions for obtaining accurate discharge data at this station are extremely poor. The channel is composed of shifting sand which scours out at high stages of the stream and immediately fills in again as the flow decreases. Continual measurements of discharge are necessary to procure reliable estimates. All results from observations at this station are approximate only.

The datum of the gage remains unchanged.

Discharge measurements of Santa Ysabel Creek near Escondido, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	48	21	2.80	60	January 30	60	23	2.40	44
January 22	62	45	2.05	127	February 8	28	18	2.24	43
January 28	57	36	1.90	101	February 17	52	28	2.19	60
January 30	61	69	2.20	311	February 21	48	24	2.12	42
January 30	62	59	2.30	242	February 26 [b]	45	20	2.06	37
February 12	52	29	1.90	67	March 2	40	20	2.05	41
February 16	77	29	1.99	62	March 5	70	42	2.20	91
February 21	47	24	2.05	55	March 6	60	32	2.10	72
March 12	52	36	2.18	97	March 14	40	16	1.95	30
March 15	40	31	2.10	111	March 19	40	16	1.98	26
April 2	82	55	2.00	177	March 25	44	15	1.92	23
April 6	87	51	1.95	146	March 31	35	16	1.91	25
April 15	57	38	1.90	95	April 7	40	14	1.91	23
April 19	51	32	1.90	82	April 12	32	12	1.87	18
May 4	37	25	2.00	61	April 18	37	10	1.86	14
May 10	37	25	2.02	58	April 25	36	18	1.85	34
May 21	47	20	1.99	40	April 29	18	9.9	1.80	16
May 24	32	21	1.99	42	May 4	37	13	1.84	21
June 4	42	16	2.01	28	May 14	20	9.5	1.82	20
June 7	52	20	2.06	35	May 20	25	7.1	1.78	10
June 17	37	13	2.02	22	May 22	20	7.4	1.77	11
July 19 [a]	14	4.2	2.02	5.7	May 29	15	6.0	1.77	9.2
December 13	16	7.7	2.28	12	June 4	15	5.5	1.77	8.2
December 21	12	5.6	2.28	10	June 10	10	3.8	1.73	5.6
December 29	16	8.4	2.32	15	June 14	10	3.5	1.72	4.9
					July 6	1.5	.45	1.61	.31
1908.					November 11	3	1.2	1.70	1.8
January 4	14	6.6	2.30	11	November 26	8	3.3	1.77	5.6
January 13	14	6.4	2.30	10	December 3	16	5.4	1.80	8.1
January 18	16	6.4	2.27	10	December 11	8	2.8	1.78	3.8
January 23	16	8	2.30	14	December 16	10	2.9	1.83	4.8
January 29	65	34	2.50	71	December 24	7	3.0	1.80	5.4

[a] Measurement made by W. A. Lamb. [b] Measurement made by Clapp and Hardy.

Daily gage height, in feet, of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908.

[S. F. Potts, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.75	1.90	2.10	2.00	2.00	2.00	1.99	2.01	2.03	2.10	2.20	2.30
2	2.70	1.95	2.10	2.00	2.00	2.00	2.00	2.02	2.04	2.10	2.20	2.30
3	2.60	1.90	2.10	2.10	2.00	2.00	2.00	2.02	2.03	2.10	2.20	2.30
4	2.60	1.90	2.20	2.00	2.00	2.00	2.01	2.01	2.03	2.10	2.20	2.25
5	2.60	1.90	2.65	1.95	2.00	2.00	2.01	2.02	2.02	2.10	2.20	2.25
6	2.90	1.85	2.35	2.00	2.00	2.00	2.00	2.02	2.02	2.15	2.25	2.25
7	2.70	1.85	2.25	1.95	2.00	2.05	2.00	2.03	2.01	2.05	2.25	2.35
8	2.60	1.85	2.20	1.95	2.00	2.05	2.00	2.02	2.00	2.05	2.25	2.35
9	2.70	1.90	2.15	1.90	2.00	2.00	2.00	2.01	2.01	2.05	2.25	2.40
10	3.00	1.85	2.10	1.90	2.00	2.00	1.99	2.02	2.01	2.00	2.30	2.40
11	2.55	1.90	2.10	1.90	2.00	2.00	2.00	2.01	2.01	2.05	2.25	2.30
12	2.60	1.90	2.20	1.95	2.00	2.00	2.02	2.01	2.02	2.05	2.25	2.30
13	2.90	1.85	2.10	1.90	2.00	2.00	2.01	2.01	2.03	2.05	2.25	2.30
14	2.50	1.90	2.00	1.90	2.00	2.05	2.01	2.01	2.02	2.05	2.25	2.30
15	2.50	1.90	2.00	1.90	2.00	2.00	2.02	2.02	2.03	2.10	2.30	2.25
16	2.50	2.00	2.10	1.95	2.00	2.00	2.03	2.04	2.05	2.10	2.30	2.30
17	2.40	2.00	2.10	1.90	2.00	2.00	2.02	2.01	2.06	2.40	2.30	2.30
18	3.00	2.05	2.10	1.90	2.00	2.00	2.01	2.02	2.07	2.10	2.35	2.30
19	2.30	2.00	2.15	1.90	2.00	2.00	2.00	2.03	.....	2.10	2.25	2.30
20	2.20	2.00	2.20	1.90	2.00	2.00	1.99	2.03	.....	2.10	2.25	2.30
21	2.10	2.00	2.20	1.90	2.00	2.00	1.99	2.03	.....	2.10	2.25	2.30
22	2.05	2.15	2.20	1.90	2.00	2.05	2.00	2.02	.....	2.10	2.30	2.30
23	2.00	2.10	2.15	1.90	2.00	2.05	2.01	2.02	.....	2.35	2.30	2.30
24	2.00	2.05	2.10	1.95	2.00	2.00	2.01	2.01	.....	2.30	2.30	2.30
25	1.90	2.00	2.45	1.95	2.00	2.00	2.02	2.01	.....	2.10	2.30	2.30

Daily gage height, in feet, of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	1.90	2.05	2.10	1.90	2.00	2.00	2.02	2.02	2.07	2.10	2.30	2.30
27	1.90	2.15	2.25	1.90	2.00	2.00	2.03	2.04	2.05	2.15	2.30	2.30
28	1.90	2.15	2.10	2.00	2.00	2.00	2.03	2.02	2.05	2.20	2.25	2.30
29	1.90	.....	2.05	2.00	2.00	2.00	2.03	2.04	2.09	2.20	2.30	2.30
30	2.25	.....	2.00	2.00	2.00	2.00	2.02	2.04	2.09	2.20	2.30	2.30
31	1.85	.....	2.00	.....	2.00	.....	2.01	2.02	.....	2.20	.....	2.30
1908.												
1	2.30	2.40	2.10	1.91	1.80	1.77	1.61	.....	.....	1.60	1.70	1.75
2	2.30	2.35	2.05	1.91	1.80	1.76	1.62	.....	.....	1.60	1.70	1.80
3	2.30	2.90	2.00	1.90	1.88	1 76	1.64	.....	.....	1.65	1.65	1.90
4	2.30	2.40	2.20	1.89	1.84	1.77	1.59	.....	.....	1.70	1.65	1.80
5	2.30	2.35	2.15	1.90	1.80	1.77	1.62	.....	.....	1.70	1.70	1.80
6	2.30	2.30	2.10	1.91	1.80	1.77	1.61	.....	.....	1.70	1.70	1.80
7	2.30	2.30	2.00	1.90	1.81	1.76	1.62	.....	.....	1.65	1.70	1.80
8	2.30	2.40	2.00	1.89	1.79	1.77	1.52	.....	.....	1.60	1.70	1.80
9	2.30	2.45	2.00	1.88	1.79	1.72	1.61	.....	.....	1.60	1.70	1.80
10	2.30	2.45	2.00	1.88	1.79	1.73	.....	.....	.....	.....	1.70	1.80
11	2.30	2.25	2.00	1.84	1.80	1.73	.....	.....	.....	.....	1.70	1.80
12	2.30	2.25	2.00	1.87	1.83	1.73	.....	.....	.....	1.65	1.70	1.75
13	2.30	2.30	2.00	1.82	1.83	1.72	1.50	.....	.....	1.70	1.70	1.75
14	2.35	2.25	1.95	1.84	1.82	1.71	.....	.....	.....	1.65	1.70	1.75
15	2.30	2.20	2.00	1.84	1.79	1.73	.....	.....	.....	1.70	1.70	1.80
16	2.30	2.20	2.00	1.84	1.78	1.73	.....	.....	.....	1.70	1.70	1.80
17	2.30	2.20	1.92	1.86	1.77	1.71	.....	.....	.....	1.75	1.70	1.80
18	2.25	2.10	1.96	1.86	1.74	1.73	.....	.....	.....	1.80	1.75	1.80
19	2.25	2.10	1.98	1.85	1.77	1.73	.....	.....	.....	1.75	1.75	1.80
20	2.30	2.10	1.93	1.83	1.78	1.73	.....	.....	.....	1.70	1.70	1.80
21	2.30	2.10	1.94	1.83	1.77	1.72	.....	.....	.....	1.70	1.70	1.85
22	2.30	2.10	1.91	1.90	1.77	1.72	.....	.....	.....	1.70	1.70	1.85
23	2.30	2.15	1.90	1.98	1.73	1.73	.....	.....	.....	1.70	1.75	1.80
24	2.50	2.10	1.92	1.90	1.76	1.70	.....	.....	.....	1.70	1.75	1.80
25	2.70	2.05	1.90	1.85	1.80	1.70	.....	.....	.....	1.70	1.75	1.80
26	2.40	2.05	1.98	1.80	1.76	1.70	.....	.....	.....	1.65	1.75	1.80
27	2.40	2.05	2.10	1.80	1.73	1.69	.....	.....	.....	1.65	1.75	1.80
28	2.55	2.10	1.95	1.78	1.76	1.66	.....	.....	.....	1.65	1.70	1.80
29	2.50	2.10	1.92	1.79	1.77	1.70	.....	.....	.....	1.70	1.75	1.80
30	2.40	.....	1.92	1.78	1.73	1.71	.....	.....	.....	1.70	1.75	1.80
31	2.40	.....	1.90	.....	1.72	.....	.....	.....	.....	1.70	.....	1.80

NOTE.—The creek was dry July 10 to 12, July 14 to September 30, and October 10 and 11, 1908.

Monthly discharge of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908.

[Drainage area, 128 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.						
January	500	40	155	1.21	1.40	9,530
February	110	50	72.4	.566	.59	4,020
March	290	50	138	1.08	1.24	8,480
April	200	67	108	.844	.94	6,430
May	65	33	49	.383	.44	3,010
June	35	16	24.6	.192	.21	1,460
July	15	5	8.6	.067	.08	529
August	5	5	5.0	.039	.04	307
September	6	5	5.5	.043	.05	327
October	15	6	8.1	.063	.07	498
November	12	9	10.2	.080	.09	607
December	15	10	12	.093	.11	738
The year	500	5	49.7	.388	5.26	35,900

Monthly discharge of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
January	136	10	25.6	.200	.23	1,570
February	146	37	54.1	.423	.46	3,110
March	82	20	37.7	.294	.34	2,320
April	44	12	20.9	.163	.18	1,240
May	25	5	13.7	.107	.12	842
June	9	1	5.06	.040	.04	301
July	1	0	.129	.0010	.001	8
August	0	0	.0	.00	.00	0
September	0	0	.0	.00	.00	0
October	2	0	.603	.0047	.005	37
November	5	1	2.74	.021	.02	163
December	17	2	5.65	.044	.05	347
The year	146	0	13.8	.108	1.45	9,940

NOTE.—Daily discharges were obtained by the indirect method for shifting channels. Values are approximate.

SAN LUIS REY RIVER DRAINAGE BASIN.

DESCRIPTION.

San Luis Rey River drains an area about 575 square miles in extent lying wholly in the northern part of San Diego County and extending from the crest of the Coast Range to the Pacific Ocean, a distance of 65 miles, with a maximum width of about 16 miles.

The river is formed by many small streams which have their sources in the higher elevations of the Coast Range and come together at the lower or west end of what is known as Warner's Valley. Below this point the river flows for a distance of 10 miles through a deep narrow canyon with a heavy grade, then over a sandy and gravelly bed with light grade for some 40 miles, finally discharging into the Pacific Ocean at Oceanside.

Altitudes within this basin range from 50 to 500 feet in the foothills in the vicinity of Oceanside and from 500 to 6,000 feet on the mountains. Palomar Mountain, the highest peak in the basin, has an elevation of 6,126 feet above sea level. The upper portion of the basin is more or less rolling, and several of the valleys are under cultivation and are used extensively for stock raising; the middle part, occupied by the river in its canyon, is rough; on the lower reaches the surface becomes less rugged, merging into the foothills, which extend to the coast. The rocks are granitic.

The basin is poorly forested. Some fairly good timber is found on the higher elevations, but the greater part of the cover is brush and grass with a scattered growth of oaks.

The mean annual precipitation in this basin probably ranges from 10 to 40 inches, gradually increasing with altitude. It occurs almost entirely as rain, snow appearing only occasionally on the high elevations.

Small areas are irrigated along the river, and water is diverted and used for irrigation and municipal supply at Escondido and vicinity. At the head of the rough canyon at the lower end of Warner's Valley is a good reservoir site. A dam constructed at this point would probably store all the normal flow of the river, but the small discharge of the stream at this point during extremely dry years makes doubtful the advisability of construction.

The stream affords little opportunity for power development. The total development with storage would probably not exceed 7,000 or 8,000 horsepower in years of normal stream flow. Within the period for which records are available the wettest year was 1906 and the driest 1904.

The only gaging station maintained in this basin is on the San Luis Rey River near Pala, Cal., 1904 to 1908.

SAN LUIS REY RIVER NEAR PALA, CAL.

This station, which is located at the road crossing to flour mill, 4 miles above Pala, was established October 9, 1903, to obtain general information regarding the flow of San Luis Rey River, the data being essential to the determination of the feasibility of storage, to the adjudication of water rights, and to further irrigation development.

No tributaries enter the river near the gaging station. Water is diverted from the river during the winter and spring months at a point in the rough canyon about 11 miles above the station to a storage reservoir, and is used during the summer period for irrigation and municipal supply at Escondido and the surrounding country.

Conditions for obtaining accurate discharge data are poor. The channel is wide, is composed of sand, gravel, and bowlders, and is subject to constant change. The current is swift at flood stages. The results from observations at this station are considered approximate only.

The datum of the gage was changed on November 13, 1906, the zero being lowered 4.66 feet.

Discharge measurements of San Luis Rey River near Pala, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 23	62	55	7.50	193	February 1	45	24	6.30	58
January 25	62	49	7.40	169	February 3	70	170	8.70	819
February 13	60	39	6.43	78	February 4	65	143	7.70	513
February 15	60	35	6.40	76	February 4	65	129	7.60	459
February 19	62	51	6.62	110	February 4	62	112	7.40	365
February 20	62	45	6.57	105	February 5	55	82	6.90	217
March 13	60	64	7.32	183	February 5	55	62	6.75	163
March 14	60	54	7.18	141	February 6	45	52	6.68	146
March 27	65	163	7.95	593	February 19	40	35	6.50	86
April 3	65	87	7.82	330	February 29	50	42	6.55	119
April 5	65	87	7.70	282	March 8	50	34	6.42	87
April 16	47	55	6.70	135	March 16	50	22	6.07	39
April 18	47	56	6.65	123	March 27	50	36	6.40	90
May 6	54	47	6.39	105	April 11	30	11	5.75	16
May 8	54	42	6.30	82	April 23	50	28	6.30	71
May 23	36	20	5.93	46	April 30	15	7.6	5.64	12
June 5	34	18	5.82	32	May 16	32	13	5.81	21
June 18	34	11	5.70	17	May 30	15	6.5	5.58	9.5
July 24[a]	6	2.2	5.40	3	June 3	15	7	5.63	12
December 11	18	8	5.73	15	June 8	13	5.2	5.56	7.4
December 23	13	6.1	5.60	9.9	July 12	3.0	1.5	5.39	2.6
					November 5	10.8	4.0	5.55	5.8
1908.					November 28	8.8	3.8	5.50	5.3
January 7	14	6.8	5.62	12	December 15	10.8	5.6	5.60	8.6
January 20	14	6.8	5.61	12	December 28	10	5.4	5.56	7.8
January 31	50	29	6.40	73					

[a] Measurement made by W. A. Lamb.

Daily gage height, in feet, of San Luis Rey River near Pala, Cal., for 1907 and 1908.

[Louis S. Salmons, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.7	7.9	6.55	7.3	6.35	5.9	5.54	5.3	5.34	5.35	5.85	5.5
2	6.55	7.4	6.5	7.9	6.3	5.85	5.52	5.32	5.34	5.35	5.9	5.5
3	6.5	7.4	6.5	7.85	6.3	5.85	5.5	5.32	5.35	5.4	5.85	5.5
4	6.5	7.35	6.8	7.7	6.25	5.85	5.5	5.3	5.35	5.5	5.85	5.5
5	6.6	7.3	9.7	7.7	6.3	5.85	5.5	5.29	5.34	5.45	5.85	5.5
6	7.9	6.9	8.0	7.65	6.4	5.85	5.51	5.28	5.35	5.5	5.8	5.5
7	7.1	6.8	8.0	7.55	6.35	5.85	5.5	5.28	5.35	5.45	5.85	5.7
8	6.7	6.75	7.7	7.4	6.3	5.8	5.5	5.3	5.34	5.5	5.85	5.75
9	6.9	6.6	7.6	7.3	6.25	5.8	5.5	5.3	5.35	5.5	5.85	5.75
10	8.85	6.5	7.55	7.15	6.2	5.8	.....	5.32	5.34	5.45	5.8	5.7
11	7.2	6.5	7.5	7.05	6.2	5.8	.....	5.33	5.35	5.5	5.8	5.75
12	6.8	6.45	7.5	6.95	6.2	5.8	.....	5.32	5.35	5.5	5.8	5.7
13	6.5	6.45	7.3	6.85	6.25	5.8	.....	5.32	5.34	5.5	5.8	5.7
14	7.85	6.4	7.2	6.85	6.2	5.75	5.37	5.3	5.35	5.5	5.8	5.7
15	7.4	6.4	7.0	6.8	6.1	5.75	5.37	5.3	5.37	5.55	5.8	5.7
16	7.5	8.5	6.95	6.75	6.05	5.75	5.37	5.31	5.37	5.7	5.8	5.7
17	7.7	7.4	6.85	6.7	6.0	5.7	5.32	5.3	5.35	5.85	5.8	5.7
18	10.8	6.8	6.8	6.65	6.0	5.7	5.33	5.3	5.35	5.8	5.95	5.65
19	10.4	6.6	6.75	6.55	6.0	5.7	5.32	5.3	5.38	5.8	5.9	5.65
20	9.6	6.55	7.0	6.5	5.95	5.7	5.32	5.3	5.38	5.8	5.85	5.6
21	8.2	6.8	8.5	6.5	5.95	5.7	5.32	5.32	5.37	5.8	5.85	5.6
22	8.1	7.4	7.2	6.45	5.9	5.7	5.32	5.32	5.35	5.9	5.8	5.6
23	7.4	7.0	7.2	6.45	5.95	5.7	5.32	5.35	5.35	6.4	5.8	5.6
24	7.45	6.9	7.0	6.45	5.9	5.75	5.33	5.35	5.38	6.5	5.8	5.6
25	7.4	6.85	8.8	6.45	5.9	5.7	5.32	5.35	5.38	6.2	5.75	5.6
26	7.4	6.75	8.5	6.45	5.85	5.7	5.31	5.36	5.37	6.0	5.7	5.6
27	7.4	6.7	7.95	6.4	5.85	5.65	5.32	5.35	5.38	5.9	5.7	5.6
28	7.4	6.6	7.4	6.4	5.85	5.65	5.30	5.37	5.38	6.0	5.65	5.7
29	7.4	.....	7.4	6.4	5.85	5.6	5.3	5.37	5.45	6.1	5.6	5.7
30	8.6	.....	7.35	6.45	5.85	5.55	5.32	5.37	5.36	6.0	5.55	5.7
31	8.4	.....	7.3	.....	5.9	.....	5.32	5.35	.....	5.9	.....	5.7
1908.												
1	5.7	6.3	6.45	5.95	5.6	5.6	5.4	5.35	.....	5.35	5.5	5.5
2	5.65	6.3	6.35	5.9	5.65	5.65	5.4	.....	.....	5.35	5.5	5.5
3	5.65	7.75	6.2	5.9	5.8	5.65	5.4	.....	.....	5.35	5.5	5.65
4	5.65	7.55	6.6	5.9	5.8	5.6	5.45	.....	.....	5.35	5.5	5.85
5	5.6	6.8	6.75	5.85	5.8	5.6	5.45	.....	.....	5.35	5.55	5.7

Daily gage height, in feet, of San Luis Rey River near Pala, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	5.65	6.7	6.6	5.85	5.75	5.6	5.45	.....	.....	5.35	5.55	5.7
7	5.6	6.55	6.45	5.85	5.75	5.6	5.45	.....	.....	5.35	5.55	5.65
8	5.6	6.4	6.4	5.85	5.75	5.55	5.45	.....	.....	5.35	5.55	5.6
9	5.6	7.1	6.4	5.8	5.7	5.6	5.4	5.85	.....	5.35	5.55	5.6
10	5.6	7.85	6.4	5.8	5.7	5.55	5.4	5.75	.....	5.35	5.55	5.6
11	5.6	7.3	6.35	5.75	5.7	5.55	5.4	5.55	.....	5.35	5.55	5.6
12	5.6	7.1	6.25	5.7	5.75	5.55	5.4	5.4	.....	5.35	5.55	5.6
13	5.65	7.0	6.15	5.7	5.75	5.55	5.4	5.35	.....	5.35	5.55	5.6
14	5.8	6.9	6.1	5.65	5.75	5.55	5.4	5.35	.....	5.35	5.6	5.6
15	6.0	6.85	6.05	5.65	5.75	5.55	5.35	.....	.....	5.35	5.6	5.6
16	5.8	6.6	6.0	5.65	5.8	5.6	5.35	.....	.....	5.4	5.55	5.65
17	5.7	6.5	5.95	5.65	5.8	5.55	5.55	.....	.....	5.5	5.6	5.7
18	5.7	6.5	5.9	5.65	5.75	5.55	5.35	.....	.....	5.5	5.6	5.65
19	5.65	6.5	5.9	5.6	5.7	5.55	5.35	.....	.....	5.5	5.6	5.55
20	5.6	6.5	5.9	5.6	5.65	5.55	5.35	.....	.....	5.5	5.6	5.5
21	5.6	6.5	5.85	5.9	5.65	5.5	5.35	.....	.....	5.5	5.6	5.5
22	5.6	6.5	5.9	6.25	5.6	5.5	5.35	.....	.....	5.5	5.6	5.5
23	5.75	6.5	5.85	6.3	5.6	5.5	5.35	.....	.....	5.5	5.6	5.5
24	6.6	6.35	5.85	6.15	5.6	5.5	5.35	.....	.....	5.45	5.55	5.55
25	7.1	6.3	5.85	5.95	5.6	5.45	5.35	.....	.....	5.5	5.55	5.55
26	6.85	6.3	6.0	5.65	5.6	5.45	5.35	.....	.....	5.5	5.55	5.55
27	6.55	6.3	6.4	5.65	5.6	5.4	5.35	.....	.....	5.5	5.55	5.6
28	7.25	6.3	6.3	5.65	5.6	5.4	5.35	.....	.....	5.5	5.5	5.6
29	7.7	6.55	6.3	5.65	5.6	5.4	5.35	.....	.....	5.5	5.5	5.6
30	6.65	.....	6.2	5.65	5.6	5.4	5.35	.....	.....	5.5	5.5	5.6
31	6.5	.....	6.0	.....	5.6	.....	5.35	.....	.....	5.5	.....	5.6

Monthly discharge of San Luis Rey River near Pala, Cal., for 1907 and 1908.

[Drainage area, 318 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	2,800	151	541	1.70	1.96	33,300	D.
February	910	79	154	.484	.50	8,550	C.
March	2,100	85	326	1.03	1.19	20,000	C.
April	410	98	167	.525	.59	9,940	C.
May	98	33	62.5	.197	.23	3,840	C.
June	40	8.0	22.8	.072	.08	1,360	B.
July	7.6	1.0	3.27	.010	.01	201	B.
August	2.4	.6	1.42	.0045	.01	87	B.
September	4.5	1.8	2.22	.0070	.01	132	B.
October	109	2.0	28.1	.088	.10	1,730	B.
November	47	8.0	27.8	.087	.10	1,650	B.
December	22	6.0	13.3	.042	.05	818	B.
The year	2,800	.6	112	.354	4.83	81,600	
1908.							
January	480	10	62.6	.197	.23	3,850	C.
February	544	60	175	.550	.59	10,100	C.
March	169	21	61.1	.192	.22	3,760	C.
April	71	10	21.3	.067	.07	1,270	C.
May	18	10	13.2	.041	.05	812	C.
June	12	4	7.4	.023	.03	440	C.
July	5	2	3.0	.0094	.01	184	C.
August	21	2	3.4	.011	.01	209	C.
September	2	2	2.0	.0063	.01	119	C.
October	5	2	3.5	.011	.01	215	C.
November	7	5	6.1	.019	.02	363	C.
December	12	5	8.6	.027	.03	529	C.
The year	544	2	30.6	.096	1.28	21,800	

NOTE.—Daily discharges for 1907 were obtained from rating tables covering short periods of time. For 1908 they were obtained by the indirect method for shifting channels and estimated on dates when gage was not read.

SANTA ANA RIVER DRAINAGE BASIN.

DESCRIPTION.

Of the three important streams—Santa Ana, San Gabriel, and Los Angeles rivers—that traverse the valley of southern California, the Santa Ana is the most important. Its drainage basin, lying south of the San Bernardino Mountains and the Sierra Madre and taking waters from their southern slopes, is the most eastern and comprises by far the largest area, including the northern part of Orange County, the northwestern part of Riverside County, and the southwestern part of San Bernardino County. Of the total drainage area, covering between 1,800 and 1,900 square miles, about two-thirds are in the valley, but only a few hundred yield much run-off.

The Santa Ana rises in the heart of the San Bernardino Mountains, about 30 miles east of Highland, and flows westward for about 25 miles to the mouth of its upper canyon; thence southwestward across San Bernardino Valley, through the lower canyon in the Santa Ana Mountains, and across the coastal plain to the Pacific Ocean at Newport Beach. Although the course of the stream measures about 100 miles, there is continuous surface flow from mountain to sea only during winter floods.

Many small streams from the southern slope of the San Bernardino Mountains and a few from the Sierra Madre west of the Cajon Pass flow toward the Santa Ana, but some of these discharge water to the main stream only in the flood seasons, the ordinary flow either being diverted or sinking into the sand and gravel of San Bernardino Valley. The principal tributaries are Bear, Alder, Mill, Lytle, and Chino creeks.

Altitudes in the Santa Ana drainage area range from a few feet above sea level on the coastal plain to 2,000 or 3,000 feet on the Santa Ana Mountains, 500 to 1,200 feet in the San Bernardino basin, and 2,000 to 11,000 feet on the southern slope of the San Bernardino Mountains. The more elevated regions are rough and rugged, and the mountain sides are incised by many canyons which are the result of active stream erosion. The rocks are granitic. The mesa and valley lands at the base of the mountains are composed of granitic gravel and sand of great depth. The higher mountain slopes support considerable timber; the lower slopes are as a rule covered with brush and grass.

The mean annual precipitation varies considerably in different parts of the Santa Ana basin. On the coastal plain west of the Santa Ana Range it averages 10 inches or more; eastward, in the San Bernardino Valley, it amounts to from 10 to 16 inches. On the mountain slopes it ranges from 20 inches at the base to 40 inches or more near the crest, and in Bear Valley north of the highest peaks, such

as San Bernardino and San Gorgonio, it may be even 50 inches. Considerable snow falls in the region of these high peaks in winter and remains well into the summer, especially on the northern slopes, from which the headwaters of the Santa Ana come.

Irrigation in the valleys of the Santa Ana basin has attained a very high state of development. Probably no other stream of its size in the United States is made to serve greater or more varied uses. To begin with, a portion of the flow is regulated by artificial storage in the upper part of the basin, and the water passes successively through three hydro-electric plants before reaching the mouth of the canyon. On leaving the lower plant it is turned into high-level canals and used for municipal supply and irrigation about Redlands and Highland. The irrigation water that escapes through seepage to the body of ground water is recovered from springs and flowing wells, and from pumped wells, and is used for irrigation around San Bernardino and Riverside, the power for pumping being generated on the upper reaches of the stream. Bed-rock obstructions at Riverside Narrows, below the city of Riverside, force to the surface a part of the water in the gravel bed of the stream above this point, and this water, after being diverted for power development, is returned to the river above Corona. Only a few miles below it is again diverted and used for irrigation on the coastal plain in the vicinity of Santa Ana and Anaheim. The seepage water from irrigation is once more recovered by numerous pumping plants and flowing wells on the lower coastal plain west of Santa Ana. It is thus evident that the same water, in passing from mountain to sea, a distance of not more than 100 miles, may be used at least eight times for power and irrigation. In like manner the water in many of the tributaries may be used several times before reaching the main stream.

Further storage and power development are feasible on the upper Santa Ana, and with a full utilization of storage sites 25,000 or 30,000 horsepower at least could be obtained continuously.

The longest run-off record in the Santa Ana basin extends back to 1896. The wettest year since that time was 1907 and the driest 1899. The total flow during the wettest year was about ten times that during the driest.

The only gaging station maintained in the basin is on Santa Ana River near Mentone, 1896 to 1908.

SANTA ANA RIVER AND MENTONE POWER COMPANY'S CANAL NEAR MENTONE, CAL.

This station, which was established in June, 1896, at the road crossing opposite Warm Spring Canyon, about three-fourths of a mile below the head works of the Mentone Power Company's canal and 5 miles northeast of Mentone, has been maintained to obtain statistical

information concerning the flow of the Santa Ana. The data show the amount and variation in flow of the water available for irrigation and power, and are useful in the adjudication of water rights. The station is about 2 miles below the mouth of Alder Creek.

Practically all the low-water flow is diverted above the station into the power canal, which returns it to the river bed below to be distributed to irrigation ditches. The flow in the canal is measured by a weir and is added to that at the station in order to obtain the total for the stream. The acquired water rights exceed the low-water flow.

Conditions for obtaining accurate discharge data are fair. The stream has a rocky bed and is subject to slight change. At high stages the current is very swift and it is difficult to get accurate gagings. The records are fairly satisfactory.

Discharge measurements of Santa Ana River near Mentone, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height of river.	Discharge.		
			River.	Mentone Power Company's canal.	Total for river.
1907.		*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
January 10	W. F. Martin	3.82	284	76	360
February 27	do	3.95	379	76	455
March 12	do	4.1	501	76	577
March 26	do	4.65	872	72	944
April 29	W. B. Clapp	3.35	184	73	257
June 12	W. F. Martin	3.00	110	70	180
June 27	W. B. Clapp	2.75	79	70	149
July 30	W. F. Martin	2.52	59	69	128
August 22	do	2.15	16	69	85
September 18	W. B. Clapp	1.85	2.6	66	69
1908.					
January 29	W. F. Martin	3.0	126	0	126
February 20	do	2.64	77	78	155
May 15	W. B. Clapp	1.85	4	68	72

Daily gage height, in feet, of Santa Ana River near Mentone, Cal., for 1907 and 1908.

[Chas. Putnam, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	3.5	3.4	4.2	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9
2	2.6	3.5	3.6	4.3	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9
3	2.5	3.7	3.2	4.4	3.6	3.0	2.8	2.4	2.1	1.9	2.4	1.8
4	2.5	3.8	3.3	4.3	3.4	3.0	2.8	2.3	2.1	1.9	2.7	1.8
5	2.5	3.8	5.3	4.2	3.4	3.0	2.8	2.3	2.0	2.0	2.7	1.8
6	3.0	3.8	4.4	4.2	3.4	3.0	2.8	2.3	2.0	2.0	2.7	1.8
7	3.0	3.4	4.1	4.2	3.1	3.0	2.8	2.3	2.0	1.9	2.3	1.8
8	3.0	3.4	4.5	4.3	3.1	3.0	2.8	2.3	1.9	1.9	2.0	1.8
9	3.0	3.2	4.4	4.3	3.0	3.0	2.8	2.2	1.9	1.9	1.9	1.8
10	4.5	3.1	3.7	4.3	3.5	3.0	2.7	2.2	1.9	1.9	2.3	1.8
11	3.6	3.1	4.2	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
12	3.6	3.0	4.1	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
13	3.7	3.0	4.0	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
14	3.8	3.0	4.0	4.3	3.2	3.0	2.7	2.2	1.9	1.9	2.7	1.8
15	3.7	2.9	3.4	4.3	3.2	3.0	2.7	2.1	1.9	1.9	2.7	1.8

Daily gage height, in feet, of Santa Ana River near Mentone, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	3.8	2.9	3.4	4.3	3.0	3.0	2.7	2.1	1.9	2.2	2.7	1.8
17	3.8	3.1	3.4	3.7	3.0	2.9	2.7	2.1	1.8	2.1	2.7	1.8
18	4.0	3.0	3.5	3.6	3.0	2.8	2.6	2.1	1.8	2.1	2.7	1.7
19	3.9	2.9	4.1	3.8	3.6	2.8	2.6	2.1	1.8	2.1	2.6	1.7
20	3.6	2.9	4.4	4.3	3.6	2.8	2.6	2.0	3.1	2.0	2.6	1.7
21	3.6	3.6	6.0	4.2	3.6	2.8	2.6	2.1	1.9	2.0	2.6	1.7
22	3.6	4.4	4.9	4.1	3.2	2.8	2.5	2.1	1.9	1.9	2.6	1.7
23	3.6	4.4	4.8	3.7	3.2	2.8	2.5	2.1	1.9	2.0	2.5	1.7
24	3.6	4.1	4.6	3.6	3.2	2.8	2.5	2.1	1.9	2.5	2.5	1.7
25	3.0	4.0	4.8	3.6	3.1	2.8	2.5	2.1	1.9	2.2	1.9	1.7
26	2.9	4.0	4.7	3.6	3.1	2.8	2.5	2.1	1.9	2.1	1.9	1.7
27	2.9	4.0	4.7	3.7	3.2	2.8	2.5	2.1	1.9	2.1	1.9	1.7
28	2.9	3.4	4.5	3.7	3.1	2.7	2.5	2.1	1.9	2.4	1.9	1.7
29	2.9	.....	4.4	3.4	3.1	2.7	2.4	2.1	1.9	2.4	1.9	1.7
30	3.4	.....	4.3	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9	1.7
31	3.0	.....	4.2	.....	3.0	.....	2.4	2.1	.....	2.4	.....	1.7
1908.												
1	1.7	2.0	3.0	2.7	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
2	1.7	2.9	2.9	2.6	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
3	1.7	2.9	2.9	2.4	2.4	1.8	1.8	1.8	1.8	1.8	1.8	1.8
4	1.7	3.6	3.0	2.2	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5	1.7	2.8	3.0	2.1	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8
6	1.7	2.5	2.5	2.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8
7	1.7	2.3	2.4	2.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
8	1.7	2.2	2.4	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
9	1.7	2.1	2.1	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
10	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
11	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
12	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
13	1.7	2.1	2.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
14	1.7	2.0	2.0	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
15	1.7	2.7	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
16	1.7	2.6	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
17	1.7	2.6	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
18	1.7	2.6	2.9	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
19	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
20	1.7	2.6	3.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
21	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
22	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
23	1.7	2.6	3.0	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
24	3.0	2.6	2.9	2.3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
25	3.4	2.6	2.9	2.3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
26	2.8	2.6	2.3	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
27	2.4	2.7	2.4	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
28	3.0	2.7	2.4	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
29	3.2	3.3	2.6	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
30	3.0	.....	2.7	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
31	3.0	.....	2.7	.....	1.8	.....	1.8	1.8	.....	1.8	.....	1.8

Rating tables for Santa Ana River near Mentone, Cal.

JANUARY 1 TO APRIL 16, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	10	3.40	155	4.30	625	5.20	1,300
2.60	18	3.50	181	4.40	700	5.30	1,375
2.70	27	3.60	210	4.50	775	5.40	1,450
2.80	38	3.70	241	4.60	850	5.50	1,525
2.90	52	3.80	275	4.70	925	5.60	1,600
3.00	69	3.90	330	4.80	1,000	5.70	1,675
3.10	88	4.00	400	4.90	1,075	5.80	1,750
3.20	108	4.10	475	5.00	1,150	5.90	1,825
3.30	131	4.20	550	5.10	1,225	6.00	1,900

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during January to March, 1907, and is well defined between gage heights 3.8 feet and 4.7 feet. Above gage height 4 feet the rating curve is a tangent, the difference being 75 per tenth.

Rating tables for Santa Ana River near Mentone, Cal.—Continued.

APRIL 17 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	1	2.40	40	3.10	132	3.80	314
1.80	2	2.50	50	3.20	150	3.90	360
1.90	4	2.60	60	3.30	170	4.00	415
2.00	9	2.70	72	3.40	192	4.10	475
2.10	15	2.80	85	3.50	217	4.20	550
2.20	22	2.90	100	3.60	243	4.30	625
2.30	31	3.00	116	3.70	276		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during April to August, 1907, and is well defined between gage heights 2.0 feet and 3.5 feet. Above gage height 4.1 feet the rating curve is a tangent, the difference being 75 per tenth.

FOR 1908.

1.70	0	2.30	33	2.90	105	3.50	217
1.80	2	2.40	43	3.00	120	3.60	240
1.90	5	2.50	54	3.10	137	3.70	264
2.00	9	2.60	66	3.20	155	3.80	289
2.10	16	2.70	78	3.30	174	3.90	315
2.20	24	2.80	91	3.40	195	4.00	342

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908 and is well defined between gage heights 1.8 feet and 4 feet.

Daily discharge, in second-feet, of Mentone Power Company's canal near Mentone, Cal., for 1907 and 1908.

[Chas. Putnam, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	76	76	76	76	76	70	69	69	69	64	76	60
2	76	76	76	76	76	70	69	69	69	64	76	60
3	76	76	76	76	76	70	69	69	69	63	76	60
4	76	76	76	76	76	70	69	69	69	68	76	59
5	76	76	76	76	74	70	69	69	69	77	76	57
6	76	76	76	76	74	70	69	69	69	73	76	59
7	76	76	76	76	74	70	69	69	69	73	76	67
8	76	76	76	76	74	70	69	69	65	69	76	62
9	76	76	76	76	74	70	69	69	65	64	76	59
10	76	76	76	76	74	70	69	69	65	66	76	60
11	76	76	76	76	74	70	69	69	60	64	76	72
12	76	76	76	76	74	70	69	69	58	64	76	62
13	76	76	76	76	74	70	69	69	62	64	76	61
14	76	76	76	76	74	70	69	69	62	64	76	61
15	76	76	76	76	74	70	69	69	62	67	76	60
16	76	76	76	76	74	70	69	69	62	72	76	60
17	76	76	76	76	74	70	69	69	64	72	76	60
18	76	76	76	76	74	70	69	69	66	73	76	59
19	.....	76	76	76	0	70	69	69	66	71	76	59
20	76	76	77	76	0	70	69	69	0	71	76	59
21	76	76	58	76	0	70	69	69	66	64	76	56
22	76	76	56	76	68	70	69	69	64	70	76	56
23	76	76	66	76	70	70	69	69	66	74	76	55
24	76	76	68	76	70	70	69	69	65	76	76	54
25	76	76	72	76	70	70	69	69	68	76	70	55
26	76	76	72	76	70	70	69	69	64	76	70	55
27	76	76	74	76	70	70	69	69	66	76	65	54
28	76	76	66	76	70	70	69	69	64	76	64	55
29	76	.....	77	73	70	70	69	69	68	76	60	55
30	76	.....	77	76	70	70	69	69	64	76	64	55
31	76	.....	76	.....	70	.....	69	69	.....	76	.....	55

Daily discharge, in second-feet, of Mentone Power Company's canal near Mentone, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	55	64	78	77	77	67	60	60	59	58	65	40
2	55	0	78	77	77	62	57	61	60	59	48	38
3	55	0	78	77	77	62	57	56	60	60	45	56
4	55	0	78	77	77	62	56	62	60	60	41	56
5	53	76	78	77	77	62	57	62	58	59	40	50
6	53	78	76	77	77	60	57	63	59	45	40	47
7	53	78	78	77	77	60	58	66	59	45	40	41
8	53	78	78	77	77	58	61	52	59	53	40	43
9	53	78	77	77	76	57	63	66	59	48	39	43
10	53	76	77	74	77	57	63	62	59	66	39	43
11	53	76	76	74	74	62	66	66	59	61	40	41
12	53	78	74	77	77	65	68	60	59	59	40	41
13	55	78	76	77	76	62	68	68	59	62	37	41
14	63	76	77	74	73	62	64	68	59	66	39	40
15	63	78	77	77	71	58	66	68	59	66	38	40
16	61	78	77	77	73	57	64	64	59	63	40	40
17	61	78	77	77	72	56	64	62	59	62	38	40
18	61	78	0	77	66	56	64	59	60	64	40	37
19	61	78	0	77	66	53	59	63	59	54	38	36
20	55	78	0	74	64	56	59	63	58	46	37	36
21	55	78	0	77	66	56	56	58	58	46	37	40
22	57	78	0	77	64	56	58	59	56	52	38	41
23	57	78	0	77	61	56	61	62	56	45	38	41
24	70	78	0	77	63	56	63	62	75	52	49	41
25	72	78	0	77	61	57	67	61	55	48	39	40
26	70	78	74	77	63	60	63	61	49	48	39	41
27	76	78	74	77	64	64	61	61	44	50	40	39
28	0	78	77	77	62	64	64	61	43	53	41	38
29	0	78	77	77	61	64	69	60	42	57	38	38
30	0	.....	77	77	67	62	69	60	44	62	41	37
31	0	.....	77	.....	71	.....	68	60	.....	61	.....	38

Monthly discharge of Santa Ana River near Mentone, Cal., for 1907 and 1908.

[Drainage area, 182 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	851	86	239	1.31	1.51	14,700	B.
February	776	128	292	1.60	1.67	16,200	B.
March	1,960	184	681	3.74	4.31	41,900	B.
April	776	265	552	3.03	3.38	32,800	B.
May	352	186	236	1.30	1.50	14,500	B.
June	186	142	171	.940	1.05	10,200	B.
July	154	109	135	.742	.86	8,300	B.
August	109	78	90.2	.496	.57	5,550	B.
September	132	62	73.2	.402	.45	4,360	B.
October	126	68	84.2	.463	.53	5,180	B.
November	148	64	119	.654	.73	7,080	B.
December	74	55	60.4	.332	.38	3,710	B.
The year	1,960	55	228.	1.25	16.94	164,000	
1908.							
January	267	53	82.1	.451	.52	5,050	A.
February	252	73	135	.742	.80	7,760	A.
March	198	83	125	.687	.79	7,690	A.
April	155	79	98.9	.543	.61	5,880	A.
May	120	63	76.3	.419	.48	4,690	A.
June	69	55	61.6	.338	.38	3,670	A.
July	71	58	64.3	.353	.41	3,950	A.
August	70	54	63.8	.351	.40	3,920	A.
September	77	44	58.8	.323	.36	3,500	A.
October	68	47	57.8	.318	.37	3,550	A.
November	67	39	42.8	.235	.26	2,550	A.
December	58	38	43.4	.238	.27	2,670	A.
The year	267	38	75.8	.416	5.65	54,900	

NOTE.—These discharges include those of the Mentone Power Company's canal.

SEEPAGE MEASUREMENTS.

Measurements to determine the amount of return water from irrigated lands on the higher elevations above Colton, Cal., and between Slover Mountain and Riverside Narrows were continued in 1907 and 1908, and measurements were also made of diversion ditches and Santa Ana River below Riverside Narrows and above what is known as the Auburndale Bridge, which were made by Kingsbury Sanborn, of Riverside, Cal.

Natural flow, in second-feet, of return water to Santa Ana River, compared with developed water in San Bernardino above Colton, Cal., 1907.

[Measurements made by Kingsbury Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
June 25	Barnhill pumping plant	1.70		1.70
September 18	do	1.30		1.30
June 21	Beam ditch		0.00	.00
September 28	do		.00	.00
June 21	Bloomington pumping plant	5.60		5.60
September 26	do	6.50		6.50
June 25	Citizens Water Co., pumping plant	4.00		4.00
September 26	do	2.00		2.00
June 20	City of San Bernardino, Sixth street pumping plant	4.00		4.00
September 28	do	2.30		2.30
June 25	City of Colton pumping plant (total)	4.50		4.50
September 18	do	4.50		4.50
June 25	City of Colton (water used for irrigating)	1.20		1.20
September 18	do	.00		.00
June 20	Camp Carlton ditch		4.40	4.40
September 25	do	3.10		3.10
June 22	Carr pumping plant	.00		.00
September 20	do	.00		.00
June 20	Daley ditch		.00	.00
September 25	do	.00		.00
June 19	Excelsior Land and Water Co	.65		.65
September 18	do	.65		.65
June 20	Grand Terrace pumping plant	.70		.70
September 20	do	.00		.00
June 20	Gage Canal, Palm avenue weir		50.10	50.10
September 20	do	33.20	.40	33.60
June 20	Gage Canal intake, Santa Ana River		.00	.00
September 20	do		.40	.40
June 21	Haws & Talmadge ditch		.08	.08
September 28	do	.00		.00
June 25	Hunter pumping plant	1.50		1.50
September 18	do	1.50		1.50
June 25	Johnson & Hubbard pumping plant	.40		.40
September 18	do	.00		.00
June 25	Lamb pumping plant	.00		.00
September 18	do	.00		.00
June 25	Lawson Well Co. pumping plant	.90		.90
September 18	do	.90		.90
June 20	Logsden & Farrell ditch	.00		.00
September 25	do	.00		.00
June 22	Lytle Creek Water and Improvement Co., pumping plant	.00		.00
September 20	do	.00		.00
June 19	Merryfield pumping plant	.70		.70
September 18	do	.70		.70
June 21	McKenzie ditch		.00	.00
September 28	do		.00	.00
June 19	Meeks & Daley ditch		22.30	22.30
October 3	do		17.10	17.10
June 25	McIntyre ditch		.00	.00
September 18	do		.00	.00
June 25	Orange Land and Water Co., pumping plant	.00		.00
September 26	do	.00	.00	.00
June 25	Riverside Highland Water Co., pumping plant	4.20		4.20
September 26	do	5.40		5.40
June 20	Riverside Highland Water Co., Santa Ana River	2.50	1.60	4.10
September 25	do	3.60		3.60
June 25	Rancheria pumping plant	2.00		2.00
September 26	do	2.00		2.00

Natural flow, in second feet, of return water to Santa Ana River, compared with developed water in San Bernardino above Colton, Cal., 1907—Continued.

Date.	Location.	Developed.	Natural.	Total.
June 21	Rabel ditch		0.60	0.60
September 28	do		1.00	1.00
June 19	Riverside Water Co., upper canal		63.00	63.00
September 26	do	16.00	30.00	46.00
June 27	Riverside Water Co., mill pumping plant	.00		.00
September 20	do	.00	.00	.00
June 19	Riverside Water Co., flume		.00	.00
September 20	do		.00	.00
June 27	Riverside Water Co., flume pump No. 1	.00		.00
September 20	do	.00		.00
June 27	Riverside Water Co., flume pump No. 2	.00		.00
September 20	do	.00		.00
June 19	Rosedale Water Co., pumping plant	.00		.00
September 26	do	.40		.40
June 19	Rogers pumping plant	.00		.00
September 18	do	2.20		2.20
June 21	Shay or Stout Dam ditch		2.60	2.60
September 28	do		1.30	1.30
June 20	Swamp ditch		2.20	2.20
September 21	do		1.00	1.00
June 19	West Riverside 350-inch Water Co. pumping plant		10.30	10.30
September 21	do	8.80		8.80
June 21	Whitlock ditch		.00	.00
September 20	do		.00	.00
June 25	Whiting ditch		.00	.00
September 25	do		.00	.00
June 20	Ward and Warren ditch		2.10	2.10
September 25	do		.00	.00

Return waters, in second-feet, in San Bernardino Valley below Slover Mountain and above Riverside Narrows, 1907.

[Measurements by Kingsbury Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
June 24	Alvitrez ditch at headgate, east end of West Riverside Bridge		0.70	0.70
September 19	do		2.50	2.50
June 24	Cuttle's pumping plant	0.00		.00
September 20	do	2.50		2.50
June 24	California Orange Co., pumping plant	.00		.00
September 20	do	1.50		1.50
June 24	Evans Island and Jansen ditch, under west end of West Riverside Bridge		4.70	4.70
September 19	do		.00	00
June 19	Evans ditch near county line		.00	.00
September 20	do		.00	.00
June 19	Evans well ditch, Santa Ana street		.00	.00
September 23	do	.80		.80
June 24	Evans pipe line to China garden at headworks		1.40	1.40
September 19	do		.00	.00
June 24	Evans pumping plant 1,000 feet south of west end of West Riverside Bridge	.00		.00
September 19	do		.00	.00
June 24	Evans Jurupa pumping plant	.00		.00
September 19	do		.00	.00
June 24	Ferris Gallagher ditch near headworks		1.10	1.10
September 19	do		3.70	3.70
June 24	Gallagher ditch		1.60	1.60
September 19	do		.00	.00
June 22	Jurupa pumping plant to supply Rubidoux ditch	.00		.00
September 23	do	4.80		4.80
June 19	Lower canal, Riverside Water Co		11.70	11.70
September 23	do		.00	.00
June 24	Pond's pumping plant	2.50		2.50
September 23	do	1.50		1.50
June 19	Rubidoux ditch at measuring box		9.80	9.80
September 23	do	4.80	1.60	6.40
June 26	Riverside Power Co. canal at Pedley crossing		49.50	49.50
September 19	do		36.00	36.00
June 24	Rivino Land Co., pumping plant No. 1	1.35		1.35
September 23	do	1.00		1.00

Return waters, in second-feet, in San Bernardino Valley below Slover Mountain and above Riverside Narrows, 1907—Continued.

Date.	Location.	Developed.	Natural.	Total.
June 26	Rivino Land Co., pumping plant No. 2	2.30		2.30
September 23	do	.00		.00
June 19	Smith or Evans ditch, 1 mile below Riverside County line		5.70	5.70
September 20	do		.00	.00
June 24	Soquel ditch at intake		1.90	1.90
September 19	do		3.70	3.70
June 22	Spring Brook pumping plant at weir at end of main	.00		.00
September 24	do		.00	.00
June 22	Spanishtown pumping plant at weir at end of main	.00		.00
September 24	do	.00		.00
June 24	Zimmerman pipe line	.00	.00	.00
September 19	do	.00	.00	.00

Discharge measurements, in second-feet, of canals between Riverside Narrows and the Auburndale Bridge having their source in Santa Ana River, 1907.

Date.	Location.	Discharge.
June 26	Castile ditch near intake	0.00
September 27	do	.00
June 26	Durkee ditch at Auburndale road crossing	3.40
September 27	do	9.80
June 26	Fuller ditch	8.30
September 27	do	1.70
June 26	Gilliland ditch at Auburndale road crossing	1.10
September 27	do	.60
June 26	Newton ditch near intake	.00
September 27	do	.00
June 26	Newberry ditch at Auburndale road crossing	.00
September 27	do	.80
June 26	Roberts or Le Gay ditch near intake, Santa Ana River	.80
September 27	do	.00
June 26	Wilbur ditch at Rogers pipe trestle crossing, Santa Ana River	00
September 27	do	.00
June 26	Santa Ana River at Auburndale Bridge	78.00
September 27	do	57.70
June 26	Santa Ana River at Auburndale Bridge, including ditches	86.00
September 27	do	66.50

SAN GABRIEL RIVER DRAINAGE BASIN.

DESCRIPTION.

San Gabriel River is one of the three most important streams traversing the valley of southern California. Its drainage basin lies wholly in Los Angeles County west of the Santa Ana basin and east of the Los Angeles basin, and stretches from the crest of the Sierra Madre to the Pacific, a distance of about 50 miles. Its total drainage area is approximately 700 square miles, about one-third of which consists of mountain slopes, which contribute practically all of the run-off except in heavy storms. The remaining two-thirds is embraced in the San Gabriel Valley at the base of the mountains and in the coastal plain southeast of the city of Los Angeles.

The mountainous part of the basin is somewhat rectangular in shape. Its length east and west is about 25 miles, and its width about 10 miles. It lies on the southern slope of the Sierra Madre opposite the basins of Big and Little Rock creeks at the north and on the

southern slope of the San Gabriel Range, through which the river breaks near Azusa and enters the San Gabriel Valley.

The main stream is formed by the junction of two principal forks, one from the north and east and the other from the west. Each of the branches receives many tributaries from the crests of the surrounding ranges. The headwaters come from the western slope of San Antonio Peak (Old Baldy), altitude 10,080 feet, and from the southern slope of other high peaks at the north, such as North Baldy and Islip mountains. The west fork drains the northern slope of Mount Wilson, the eastern and northern slopes of San Gabriel Peak, and a portion of the southern slopes of the main range to the north. It joins the main stream about 8 miles above the mouth of the canyon. The general course of the stream is southwestward. After leaving the mountains it traverses San Gabriel Valley in a wide wash of sand, gravel, and bowlders, then breaks through the range of foothills separating San Gabriel Valley from the coastal plain at a point called The Narrows, about 5 miles northwest of Whittier, and enters the coastal plain, across which it flows to its mouth in Alamitos Bay, a few miles east of Long Beach. The total length of the stream is about 65 or 70 miles.

The principal tributaries of San Gabriel River are Fish Fork and Cattle Creek from the east, and Iron and West forks from the west.

Altitudes in San Gabriel basin range from 20 to 200 feet on the Coastal Plain, from 200 to 900 feet in San Gabriel Valley, and from 1,000 to 10,000 feet in the mountains. The range of foothills near Whittier has an altitude of about 1,250 feet. The topography is rough and rugged in the mountains, especially in the upper part, where deep and narrow canyons exist. The geologic formation is granitic, with a light soil covering. The San Gabriel Valley is more or less rolling and is composed of granitic wash from the mountains.

The basin is rather poorly forested, having a sparse timber growth on the higher slopes and brush with some scattering timber on the middle and lower elevations.

The mean annual precipitation in this basin ranges from 15 to 20 inches in the valley area, and from 20 to 40 inches in the mountains. It occurs almost entirely as rain except on the higher peaks, where snow falls during the winter. On the northern slopes snow remains for several months.

The total summer flow of the stream is used for irrigation, and the same water may be put to use several times in its journey from mountain to sea. About 5 miles above the mouth of the canyon a power canal, with a capacity of 80 second-feet, takes water from the left bank of the stream and delivers it to irrigation canals below the wheels near the mouth of the canyon for irrigation in San Gabriel Valley. Some other small diversions are made in the spring months

at and below the mouth of the canyon for the same purpose. Most of the excess water issuing from the canyon sinks into the sands and gravels of San Gabriel Valley to augment the underground basins, which are drawn upon for irrigating the lower part of the valley.

Above The Narrows at the lower end of the valley the underground flow is forced to the surface by a bed-rock obstruction, and this water, with additional water developed from many wells, is diverted through ditches for irrigating the higher parts of the coastal plain. The seepage loss from irrigation joins the body of underground water and is recovered from pumped and flowing wells in the lower coastal plain. Storage sites are practically lacking in this basin and opportunities for power development are not great. Probably not more than one-fifth as much power could be obtained in this basin as in the basin of the Santa Ana.

Run-off records in this basin extend back to 1896. The wettest year since that time was 1907 and the driest was 1899. The total flow during the wettest year was nearly 33 times that during the driest.

The only gaging station maintained in the basin is on San Gabriel River near Azusa, 1896 to 1908.

SAN GABRIEL RIVER AND POWER CANAL NEAR AZUSA, CAL.

This station, which is located just above the road crossing at the mouth of the canyon, about one-fourth mile above the Pacific Light and Power Company's power house and 2 miles north of Azusa, was established in 1896 to obtain general information for use in connection with power and irrigation development and in the adjudication of water rights. Estimates of flow were very unsatisfactory until after the completion of the power canal in 1898.

The station is well below all tributaries and is several miles below the power and irrigation diversion. The discharge in the canal is measured by a weir and is added to that at the station to obtain the total flow of the stream. The acquired water rights greatly exceed the low-water flow of the stream.

The channel is composed of gravel and bowlders and is subject to considerable change, especially above and below the measuring section; the current is very swift, and gagings at flood stages are difficult; and various temporary diversions for irrigation just above the station affect the discharge. The results are not very satisfactory.

Discharge measurements of San Gabriel River and power canal near Azusa, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			River.	Canal.	Total.
1907.		*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
January 2	Clapp and Martin	3.03	169	76	245
January 9	W. F. Martin	4.88	1,110	76	1,190
January 19	do	4.3	706	76	782
February 7	do	4.8	1,020	76	1,100
February 28	do	4.2	618	76	694
March 5	do	7.4	5,980	76	6,060
Do	do	7.0	5,060	76	6,040
March 6	do	6.5	3,660	76	3,740
Do	do	6.4	3,310	76	3,390
March 8	do	6.0	2,590	76	2,670
Do	do	6.0	2,630	76	2,710
March 13	do	5.2	1,400	76	1,480
Do	do	5.15	1,350	76	1,430
March 27	do	6.3	2,020	76	2,100
Do	do	6.2	1,900	76	1,980
April 5	do	5.4	1,240	76	1,320
Do	do	5.4	1,290	76	1,370
April 15	do	5.0	893	76	969
April 30	W. B. Clapp	4.4	460	76	536
May 24	do	3.9	258	76	334
June 13	do	3.6	192	76	268
June 28	do	3.35	141	76	217
July 11	do	3.1	88	76	164
July 29	W. F. Martin	2.8	53	76	129
August 22	do	2.1	2.8	76	79
1908.					
January 27	W. F. Martin	3.8	271	76	347
February 3	do	5.6	1,885	76	1,961
February 19	do	3.35	127	76	203
April 14	W. B. Clapp	3.2	80	76	156
April 28	do	3.1	73	76	149
May 18	W. F. Martin	2.85	47	76	123
May 26	W. B. Clapp	2.55	31	76	107
June 13	do	.....	4	76	80

Daily gage height, in feet, of San Gabriel River near Azusa, Cal., for 1907 and 1908.

[Jno. Woodward and A. W. Peake, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
1	3.2	4.2	4.2	5.7	4.3	3.7	2.8	2.6	2.2	.....	2.1
2	3.1	4.2	4.1	5.7	4.2	3.7	3.0	2.6	2.1	.....	2.0
3	2.9	4.6	4.1	5.7	4.2	3.7	3.2	2.5	2.1	.....	.....
4	2.9	4.6	4.1	5.6	4.1	3.7	3.3	2.5	2.1	.....	.....
5	2.2	4.7	7.6	5.5	4.1	3.7	3.2	2.5	2.0	.....	.....
6	3.2	4.7	6.7	5.4	4.1	3.7	3.2	2.5	2.0	.....	.....
7	3.6	4.5	6.2	5.3	4.0	3.7	3.2	2.5	2.0	.....	.....
8	5.2	4.4	6.1	5.3	4.0	3.7	3.2	2.4	.....	.....	.....
9	5.5	4.3	6.1	5.2	4.0	3.65	3.1	2.4	.....	.....	.....
10	6.85	4.3	6.1	5.2	3.9	3.65	3.0	2.4	.....	.....	.....
11	5.7	4.2	6.0	5.2	3.9	3.65	3.0	2.4	.....	.....	.....
12	5.5	4.2	5.4	5.2	3.9	3.65	3.0	2.4	.....	.....	.....
13	5.2	4.1	5.3	5.2	3.85	3.6	2.9	2.3	.....	.....	.....
14	4.5	4.1	5.2	5.2	3.85	3.6	2.8	2.3	.....	.....	.....
15	4.6	4.1	5.1	5.2	3.85	3.6	2.8	2.2	.....	.....	.....
16	4.5	4.1	4.8	5.0	3.85	3.6	2.8	2.2	.....	2.1	.....
17	4.5	4.9	4.7	5.0	3.85	3.55	2.8	2.2	.....	2.2	.....
18	4.6	4.9	4.6	4.9	3.85	3.55	2.7	2.2	.....	2.1	.....
19	4.5	4.6	4.6	4.8	3.8	3.55	2.7	2.2	.....	2.0	.....
20	4.3	4.2	4.7	4.7	3.8	3.5	2.7	2.2	.....	2.0	.....
21	4.1	4.2	6.1	4.7	3.8	3.5	2.7	2.1	.....	.....	.....
22	4.0	4.9	5.8	4.6	3.8	3.45	2.6	2.1	.....	.....	.....
23	4.0	4.6	5.3	4.6	3.8	3.45	2.6	2.1	.....	.....	.....
24	3.9	4.3	5.8	4.6	3.8	3.4	2.6	2.1	.....	2.0	.....
25	4.1	4.3	6.0	4.6	3.8	3.4	2.6	2.1	.....	2.1	.....

Daily gage height, in feet, of San Gabriel River near Azusa, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
26	4.2	4.2	6.5	4.5	3.8	3.4	2.6	2.1	.....	2.0	.....
27	4.1	4.2	6.0	4.5	3.8	3.35	2.6	2.1	.....	2.3	.....
28	4.1	4.2	6.0	4.4	3.75	3.35	2.6	2.1	.....	2.5	.....
29	4.3	.....	6.0	4.4	3.75	3.3	2.6	2.1	.....	2.4	.....
30	4.5	.....	6.0	4.4	3.75	3.3	2.6	2.1	.....	2.2	.....
31	4.4	.....	5.8	.....	3.75	.....	2.6	2.2	.....	2.1	.....
1908.											
1	.....	3.6	3.5	3.4	3.1	2.4	.....	2.7	.....	.....	.....
2	.....	3.6	3.4	3.4	3.2	2.3	.....	.....	.....	.....	.....
3	.....	3.7	3.4	3.5	3.2	2.3	.....	.....	.....	.....	.....
4	.....	4.7	3.3	3.4	3.1	2.3	.....	.....	.....	.....	.....
5	.....	4.2	3.3	3.3	3.1	2.3	.....	.....	.....	.....	.....
6	.....	4.0	3.3	3.3	3.1	2.3	.....	.....	.....	.....	.....
7	.....	3.7	3.3	3.2	3.1	2.3	.....	.....	.....	.....	.....
8	.....	3.6	3.2	3.1	3.0	2.3	.....	.....	.....	.....	.....
9	.....	3.6	3.2	3.1	3.0	2.2	.....	.....	.....	.....	.....
10	.....	3.9	3.1	3.0	3.3	2.2	.....	.....	.....	.....	.....
11	.....	3.7	3.0	3.0	3.0	.....	.....	.....	.....	.....	.....
12	.....	3.7	3.0	3.1	3.0	.....	.....	.....	.....	.....	.....
13	.....	3.6	3.2	3.1	3.0	.....	.....	.....	.....	.....	.....
14	.....	3.6	3.2	3.1	3.0	.....	.....	.....	.....	.....	.....
15	2.4	3.4	3.2	3.2	2.9	.....	.....	.....	.....	.....	.....
16	2.2	3.4	3.6	3.2	2.9	.....	.....	.....	.....	.....	.....
17	2.0	3.4	3.7	3.1	2.9	.....	.....	.....	.....	.....	.....
18	.....	3.4	3.7	3.1	2.8	.....	.....	.....	.....	.....	.....
19	.....	3.4	3.7	3.1	2.8	.....	.....	.....	.....	.....	.....
20	.....	3.4	3.7	3.0	2.8	.....	.....	.....	.....	.....	.....
21	.....	3.4	3.7	3.0	2.8	.....	.....	.....	.....	.....	.....
22	.....	3.4	3.6	3.0	2.5	.....	.....	.....	.....	.....	.....
23	.....	3.4	3.4	3.1	2.5	.....	.....	.....	.....	.....	.....
24	4.8	3.3	3.4	3.1	2.5	.....	.....	.....	.....	.....	.....
25	5.3	3.3	3.6	3.1	2.5	.....	.....	.....	.....	.....	.....
26	4.5	3.3	3.6	3.0	2.5	.....	.....	.....	.....	.....	.....
27	4.0	3.3	3.5	3.1	2.5	.....	.....	.....	.....	.....	.....
28	3.8	3.3	3.4	3.1	2.4	.....	.....	.....	.....	.....	.....
29	3.9	3.5	3.4	3.1	2.4	.....	.....	.....	.....	.....	.....
30	3.7	.....	3.4	3.1	2.4	.....	.....	.....	.....	.....	.....
31	3.6	.....	3.4	.....	2.5	.....	.....	.....	.....	.....	.....

NOTE.—The river was dry on the days on which the gage was not read.

Rating tables for San Gabriel River near Azusa, Cal.

JANUARY 1 TO MARCH 13, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1	3.10	190	4.20	660	5.60	1,910
2.10	4	3.20	225	4.30	710	5.80	2,220
2.20	12	3.30	260	4.40	760	6.00	2,600
2.30	22	3.40	300	4.50	820	6.20	3,000
2.40	35	3.50	340	4.60	890	6.40	3,450
2.50	50	3.60	380	4.70	960	6.60	3,950
2.60	67	3.70	420	4.80	1,030	6.80	4,460
2.70	85	3.80	460	4.90	1,110	7.00	5,010
2.80	105	3.90	510	5.00	1,200	7.20	5,570
2.90	130	4.00	560	5.20	1,400	7.40	6,130
3.00	160	4.10	610	5.40	1,630	7.60	6,730

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on thirteen discharge measurements made during January to March, 1907, and is well defined between gage heights 3 feet and 7.5 feet.

Rating tables for San Gabriel River near Azusa, Cal.—Continued.

MARCH 14 TO 26, 1907.

[Indirect method for shifting channel used.]

MARCH 27 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1	2.90	63	3.80	240	4.70	655
2.10	3	3.00	77	3.90	270	4.80	730
2.20	6	3.10	92	4.00	302	4.90	810
2.30	11	3.20	108	4.10	336	5.00	890
2.40	17	3.30	125	4.20	374	5.20	1,050
2.50	24	3.40	143	4.30	415	5.40	1,210
2.60	32	3.50	163	4.40	460	5.60	1,380
2.70	41	3.60	186	4.50	515	5.80	1,560
2.80	51	3.70	212	4.60	585	6.00	1,740

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twelve discharge measurements made during March to August, 1907, and is fairly well defined between gage heights 2 feet and 6.3 feet.

FOR 1908.

2.00	0	3.00	56	4.00	309	4.90	845
2.10	1	3.10	71	4.10	353	5.00	925
2.20	2	3.20	87	4.20	401	5.20	1,085
2.30	4	3.30	105	4.30	452	5.40	1,245
2.40	6	3.40	126	4.40	505	5.60	1,405
2.50	10	3.50	149	4.50	560	5.80	1,575
2.60	16	3.60	174	4.60	620	6.00	1,745
2.70	23	3.70	202	4.70	690	6.20	1,915
2.80	32	3.80	234	4.80	765	6.40	2,085
2.90	43	3.90	270				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nineteen discharge measurements made during 1907 and 1908, and is fairly well defined.

Daily discharge, in second-feet, of San Gabriel power canal near Azusa, Cal., for 1907 and 1908.

[John Woodward and A. W. Peake, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	76	76	76	76	76	76	76	76	76	51	76	54
2	76	76	76	76	76	76	76	76	76	50	76	54
3	76	76	76	76	76	76	76	76	76	50	76	53
4	76	76	76	76	76	76	76	76	76	50	71	54
5	76	76	76	76	76	76	76	76	76	58	69	54
6	76	76	76	76	76	76	76	76	76	63	66	54
7	76	76	76	76	76	76	76	76	72	60	65	76
8	76	76	76	76	76	76	76	76	67	56	66	76
9	76	76	76	76	76	76	76	76	59	54	67	67
10	76	76	00	76	76	76	76	76	59	50	76	63
11	76	76	76	76	76	76	76	76	57	50	73	66
12	76	76	76	76	76	76	76	76	57	50	66	62
13	76	76	76	76	76	76	76	76	57	50	64	58
14	76	76	76	76	76	76	76	76	57	50	63	57
15	76	76	76	76	76	76	76	76	57	66	62	57
16	76	76	76	76	76	76	76	76	57	76	61	57
17	76	76	00	76	76	76	76	76	57	76	58	57
18	76	76	76	76	76	76	76	76	57	75	59	57
19	76	76	76	76	76	76	76	76	57	70	59	57
20	76	76	76	76	76	76	76	76	56	67	61	57
21	76	76	76	76	76	76	76	76	53	61	61	56
22	76	76	76	76	76	76	76	76	51	66	61	55
23	76	76	76	76	76	76	76	76	50	76	61	55
24	76	76	76	76	76	76	76	76	50	76	58	54
25	76	76	76	76	76	76	76	76	50	76	57	54

Daily discharge, in second-feet, of San Gabriel power canal near Azusa, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	76	76	76	76	76	76	76	76	50	76	57	54
27	76	76	76	76	76	76	76	76	50	76	57	54
28	76	76	76	76	76	76	76	76	50	76	57	65
29	76	76	76	76	76	76	76	76	50	76	56	67
30	76	.....	76	76	76	76	76	76	51	76	55	57
31	76	.....	76	.....	76	.....	76	76	.....	76	.....	57
1908.												
1	56	76	76	76	76	76	48	37	29	30	32	34
2	54	76	76	76	76	76	47	42	29	31	32	57
3	54	76	76	76	76	76	45	43	28	38	32	80
4	52	76	76	76	76	76	44	42	26	36	32	80
5	52	76	76	76	76	76	45	40	26	35	32	81
6	51	76	76	76	76	76	43	40	26	34	31	67
7	51	76	76	76	76	76	43	39	26	32	32	56
8	50	76	76	76	76	76	42	39	28	30	32	47
9	50	76	76	76	76	76	42	37	29	30	32	47
10	50	76	76	76	27	76	42	42	32	29	32	44
11	50	76	76	76	76	76	42	41	30	29	33	44
12	48	76	76	76	76	76	42	39	28	30	33	43
13	49	76	76	76	76	76	42	38	27	32	33	43
14	76	76	76	76	76	76	41	37	26	32	33	43
15	76	76	76	76	76	76	40	37	26	32	33	41
16	66	76	76	76	76	76	39	37	26	34	33	41
17	58	76	76	76	76	76	39	35	27	40	33	43
18	56	76	76	76	76	76	39	34	28	40	33	40
19	56	76	76	76	76	76	39	34	27	39	33	40
20	56	76	76	76	76	76	38	32	26	39	33	40
21	54	76	76	76	76	76	37	32	28	38	33	40
22	54	76	76	76	76	76	37	31	28	36	33	40
23	65	76	76	76	76	76	36	30	26	34	33	40
24	76	76	76	76	76	56	36	30	62	34	33	40
25	76	76	76	76	76	54	36	30	54	34	33	40
26	76	76	76	76	76	53	36	30	39	32	33	40
27	76	76	76	76	76	52	36	30	36	33	36	40
28	76	76	76	76	76	51	36	29	33	32	35	39
29	76	.....	76	76	76	50	35	29	32	32	34	39
30	76	.....	76	76	76	49	34	29	31	32	34	39
31	76	.....	76	.....	76	.....	33	29	.....	32	.....	39

NOTE.—These discharges were obtained by means of weirs.

Monthly discharge of San Gabriel River near Azusa, Cal., for 1907 and 1908.

[Drainage area, 222 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	4,670	88	949	4.27	4.92	58,400	C.
February	1,190	686	848	3.82	3.98	47,100	C.
March	6,810	686	1,880	8.47	9.76	116,000	C.
April	1,550	491	982	4.42	4.93	58,400	B.
May	491	302	350	1.58	1.82	21,500	B.
June	288	201	254	1.14	1.27	15,100	B.
July	201	108	136	.613	.71	8,360	B.
August	108	79	87.7	.395	.46	5,390	B.
September	82	50	60.2	.271	.30	3,580	B.
October	100	50	66.5	.300	.35	4,090	B.
November	79	55	63.9	.288	.32	3,800	B.
December	76	53	58.6	.264	.30	3,600	B.
The year	6,810	53	478	2.15	29.12	345,000	

Monthly discharge of San Gabriel River near Azusa, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,240	48	180	0.811	0.94	11,100	C.
February	766	181	260	1.17	1.26	15,000	C.
March	278	132	207	.932	1.07	12,700	C.
April	225	132	156	.703	.78	9,280	C.
May	163	82	117	.527	.61	7,190	C.
June	82	49	70.4	.317	.35	4,190	C.
July	89	34	41.6	.187	.22	2,560	C.
August	60	29	36.0	.162	.19	2,210	C.
September	62	26	30.6	.138	.15	1,820	C.
October	40	29	33.6	.151	.17	2,070	C.
November	36	31	32.9	.148	.17	1,960	C.
December	80	34	46.7	.210	.24	2,870	C.
The year	1,240	26	101	.455	6 15	73,000	

NOTE.—These discharges include the water in the river at the station and the water diverted through the power canal. During April and May, 1908, some water was diverted just above the station for irrigation. The quantity was variable, but probably averaged about 10 second-feet. This is not included in the above.

LOS ANGELES RIVER DRAINAGE BASIN.

DESCRIPTION.

Los Angeles River is formed by Tujunga, Pacoima, and other small creeks whose sources lie in the Sierra Madre northeast of the city of Los Angeles. These streams leave the mountains at a point about 25 miles above the city and enter the comparatively flat country of the San Fernando Valley, where, except at times of excessive flood, the waters disappear in the sand and gravel washes. At the lower end of this valley is a secondary range of hills, extending from east to west, and bed rock obstruction forces the waters to the surface to form what is known as Los Angeles River. Below this point the river flows through the flat country of the Los Angeles Valley and enters the Pacific near the town of Long Beach.

During the summer months the entire flow of Los Angeles River is diverted at a point about 5 miles above Los Angeles for the supply of the city, only a small amount of water passing this point except during flood periods.

DIVERSIONS FROM LOS ANGELES RIVER.

The amount of water diverted from Los Angeles River by the city of Los Angeles was measured during the summers of 1907 and 1908 in the 44-inch conduit and in the main-supply conduit. The supply is taken from the river near Burbank and includes the entire surface flow of the river at this point during the summer months. Some

return seepage water again appears in the river channel near Huron street, Los Angeles, near which point the city has an underground gallery or tunnel for collecting an auxiliary supply, which is pumped into the reservoir and used in the general distributing system. The following table shows the results of the measurements:

Measurements of flow, in second-feet, of diversions from Los Angeles River by the city of Los Angeles.

Date.	44-inch conduit discharge.	Main-supply conduit discharge.	Total.	Date.	44-inch conduit discharge.	Main-supply conduit discharge.	Total.
1907.				1908.			
April 8	42.50	22.61	65.11	May 21	43.31	13.81	57.12
May 9	44.96	19.50	64.46	June 25	42.72	12.67	55.39
June 5	50.46	8.55	59.01	July 31	37.73	12.96	50.69
July 12	35.13	18.03	53.16	August 3	33.34	17.16	50.60
August 8	32.24	17.38	49.62	August 5	38.12	13.00	51.12
August 29	36.45	14.69	51.14	August 7	35.73	15.16	50.89
October 8	38.51	16.26	54.77	August 26	34.73	16.43	51.16
November 9	35.52	19.63	55.15	September 22	38.73	16.30	55.03
				October 23	40.24	14.65	54.89
1908.				November 20	35.54	21.78	57.32
April 29	44.44	12.30	56.74	December 30	36.91	22.98	59.89

SANTA YNEZ RIVER DRAINAGE BASIN.

DESCRIPTION.

Santa Ynez River is the only important stream lying wholly in Santa Barbara County. Its drainage basin lies north of the Santa Ynez Mountains, extending for a distance of about 80 miles parallel to the coast line, and comprising approximately 900 square miles. Four-fifths of this area is mountainous, including the north slope of the Santa Ynez and the south slope of the San Rafael mountains, and furnishes practically all of the run-off.

Santa Ynez River rises near the boundary line between Ventura and Santa Barbara counties, where the Santa Ynez and San Rafael mountain ranges merge, flows nearly due west, and enters the Pacific Ocean at Surf, about 8 miles north of Point Arguello light-house, where the coast line makes a sharp turn to the north.

Small tributaries are numerous, but the only one of importance is Mono Creek, which drains 120 square miles of the southern slope of the San Rafael Mountains, and joins the Santa Ynez River about 13 miles below its source.

Elevations in the Santa Ynez Mountains range from 3,000 to 4,000 feet; in the San Rafael Mountains they range from 4,000 to 6,000 feet, with a few high peaks, such as Mount Pinos, extending 8,826 feet above sea level. The rocks throughout the entire basin consist of shale, sandstone, and conglomerate.

The greater part of the drainage basin is included in a national forest and is sparsely covered with brush and small trees, only small areas on the higher elevations having any considerable growth of timber.

The mean annual precipitation in the area ranges from 20 to 30 inches, the increase being gradual from the lower to the higher altitudes, and is almost entirely rain, there being only a light snowfall on the higher elevations during the winter months.

Some small diversions for irrigation are made above Lompoc, and present water rights exceed the low-stage flow of the stream. The basin affords good storage sites. Several reservoirs have already been surveyed and their combined capacity far exceeds the mean annual run-off.

No important water-power development is possible in the Santa Ynez basin.

The following stations have been maintained in this basin:

Santa Ynez River near Santa Barbara (1903 to 1908).
Santa Ynez River near Lompoc (1906 to 1908).
Mono Creek near Santa Barbara (1903 to 1904).

SANTA YNEZ RIVER NEAR SANTA BARBARA, CAL.

This station, which is located at what is known as the Gibraltar dam site, about 3½ miles below the mouth of Mono Creek, in T. 5 N., R. 27 W., San Bernardino meridian, is maintained by the city of Santa Barbara through its board of water commissioners and Lee M. Hyde, engineer, to determine the quantity of water available for storage at the Gibraltar reservoir.

No important tributaries enter the river near the station and no diversions are made above. Water rights far exceed the mean low flow of the stream. The channel is fairly permanent and good results can be obtained if a reliable daily gage record is kept, but this is difficult owing to the isolated location of the station.

No changes have been made in the datum of the gage. No discharge measurements were made during 1907 and 1908.

Daily gage height, in feet, of Santa Ynez River near Santa Barbara, Cal., for 1907 and 1908.

Day.	1907.							1908.
	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.
1	2.52	3.6	2.9	3.95	1.81	2.05	1.91	.....
2	2.52	3.55	2.87	3.85	.....	.....	.....	.....
3	2.5	4.0	2.8	3.8	.....	2.0	1.92	.....
4	2.49	4.25	9.5	3 65	.....	.....	.....	1.95
5	2.48	4.2	8.0	3.6	1.81	.....	.....	.....
6	2.7	4.2	7.0	3.5	.....	1.98	1.92	.....
7	3.6	4.15	5.2	3.6	.....	1.98	.....	1.94
8	9.3	4.1	4.1	3.4	1.82	.....	.....	.....
9	10.4	3.95	4.05	3.35	.....	.....	2.3	1.93
10	7.0	3.9	4.0	3.3	.....	1.97	.....	.....
11	5.8	3.85	4.0	3.3	.....	.....	2.15	1.93
12	5.0	3.8	3.75	3.25	.....	1.98	.....	.....
13	4.5	3.75	3.7	3.15	.....	.....	.....	1.92
14	4.1	3.7	3.65	3.1	.....	1.98	2.12	2.17
15	4.3	3.75	3.65	3.05	.....	.....	.....	2.12
16	4 2	3.8	3.6	3.0	.....	1.97	.....	.....
17	5.25	3.8	3.55	2.97	.....	1.97	2.1	2.09
18	4.3	3.55	3.5	2.95	.....	.....	.....	.....
19	4.3	3.2	7.45	2.94	.....	1.96	2.08	.....
20	4.3	2.95	6.3	2.92	.....	.....	.....	2.06
21	4.3	2.95	5.85	2.9	1.83	.....	.....	.....
22	4.3	3.7	5.5	2.85	.....	.....	.....	.....
23	4.3	3.5	5.3	2.81	.....	1.94	2.08	2.04
24	4.3	3.3	5 0	2.8	2.01	.....	.....	.....
25	4.3	3.2	7.0	2.76	1.99	.....	2.06	6.40
26	4.3	3.1	5.45	2.72	2.3	.....	.....	5.00
27	4.3	2.97	4.7	2.69	3.42	1.92	2.05	5.00
28	4.2	2.93	4.6	2.66	2.4	.....	2.0	4.00
29	4.1	.....	4.4	2.63	.....	1.91	2.0	3.01
30	4.0	.....	4.3	2.61	2.21	1.9	.....	2.78
31	3.55	.....	4.2	.....	.....	.....	1.98	2.61

Rating table for Santa Ynez River near Santa Barbara, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	1	3.00	156	4.40	1,065	6.80	4,230
1.90	2	3.10	186	4.60	1,285	7.00	4,520
2.00	3	3.20	223	4.80	1,510	7.20	4,810
2.10	6	3.30	265	5.00	1,750	7.40	5,100
2.20	12	3.40	315	5.20	1,990	7.60	5,390
2.30	22	3.50	370	5.40	2,250	7.80	5,680
2.40	35	3.60	430	5.60	2,510	8.00	5,970
2.50	49	3.70	495	5.80	2,790	9.00	7,420
2.60	65	3.80	565	6.00	3,070	10.90	8,870
2.70	83	3.90	635	6.20	3,360	11.00	10,320
2.80	104	4.00	710	6.40	3,650		
2.90	129	4.20	875	6.60	3,940		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and is fairly well defined between gage heights 1.8 feet and 9 feet. Above gage height 6 feet the rating curve is a tangent, the difference being 145 per tenth.

Monthly discharge of Santa Ynez River near Santa Barbara, Cal., for 1907.

[Drainage area, 207 square miles.]

Month.	Discharge in second-feet.				Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,450	49	1,470	7.10	90,400	B
February	920	142	490	2.37	27,200	B.
March	8,150	104	1,520	7.34	93,500	B.
April	670	65	237	1.14	14,100	B.
October	315	1	14.4	.07	885	B.
November	4	2	2.7	.013	161	B.
December	22	2	5.6	.027	344	B.
The period					227,000	

SANTA YNEZ RIVER NEAR LOMPOC, CAL.

This station, which was established November 10, 1906, to determine the amount of water available below the Gibraltar station, and to obtain data for the adjudication of water rights, was originally at wagon bridge, 1½ miles east of Lompoc. Early in January, 1907, the bridge was destroyed by heavy floods. A new bridge was built during the summer of 1907, and the station was reestablished September 25, 1907, at the same location.

No tributaries enter the stream in the vicinity of the station and no diversions have been made above since the station was established. The headworks of canals previously diverting water were destroyed by floods and have not been reconstructed. Acquired water rights exceed the low flow of the stream. The drainage area above the station is about 785 square miles.

The conditions at this station are extremely unfavorable for accuracy of measurements. The channel is wide and the stream at medium and low stages constantly shifts. Results obtained are approximate only. The datum of the gage has remained unchanged.

Discharge measurements of Santa Ynez River at Lompoc, Cal., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 10	R. S. Hawley	36	13	5.02	10
December 12	L. M. Hyde	107	144	5.88	259
1907.					
September 24	Clapp and Hyde	20	18	2.75	30
1908.					
January 28	L. M. Hyde	259	742	4.80	3,480
January 29	do	221	421	3.85	1,490
March 10	W. F. Martin	272	225	3.28	418

Daily gage height, in feet, of Santa Ynez River near Lompoc, Cal., for 1906, 1907, and 1908.

[John Loynachan, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1906.			1906.			1906.		
1		5.1	11	5.0	5.3	21	5.0	5.3
2		5.1	12	5.0	6.2	22	5.0	5.3
3		5.1	13	5.0	6.2	23	5.0	5.3
4		5.1	14	5.0	5.85	24	5.0	5.3
5		5.1	15	5.0	5.65	25	5.05	5.3
6		5.1	16	5.0	5.5	26	5.05	5.35
7		5.1	17	5.0	5.45	27	5.1	5.6
8		5.1	18	5.0	5.35	28	5.1	6.75
9		5.1	19	5.0	5.35	29	5.1	6.4
10	5.0	5.1	20	5.0	5.35	30	5.1	6.25
						31		6.15

Day.	Jan.	Sept.	Oct.	Nov.	Dec.	Day.	Jan.	Sept.	Oct.	Nov.	Dec.
1907.						1907.					
1	6.1		2.75	3.05	2.85	16			2.75	2.9	2.9
2	5.95		2.75	3.0	2.85	17			2.75	2.9	2.9
3	5.85		2.75	2.95	2.85	18			2.75	2.9	2.9
4	5.8		2.75	2.95	2.85	19			2.75	2.9	2.85
5	5.95		2.75	2.95	2.85	20			2.75	2.85	2.85
6	6.0		2.75	2.9	2.9	21			2.75	2.85	2.85
7	6.9		2.75	2.9	2.95	22			2.8	2.85	2.85
8	16.2		2.75	2.9	2.95	23			3.0	2.85	2.85
9	20.5		2.75	2.9	2.95	24			3.0	2.85	2.85
10			2.75	2.9	2.9	25		2.75	3.05	2.85	2.85
11			2.75	2.9	2.9	26		2.75	3.35	2.85	2.85
12			2.75	2.9	2.85	27		2.75	3.25	2.85	2.85
13			2.75	2.9	2.85	28		2.75	3.35	2.85	2.85
14			2.75	2.9	2.85	29		2.75	3.2	2.85	2.85
15			2.75	2.9	2.85	30		2.75	3.15	2.85	2.85
						31			3.05		2.85

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.85	3.6	3.7	3.15	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7
2	2.85	3.85	3.65	3.1	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7
3	2.85	5.35	3.65	3.1	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.8
4	2.85	5.0	3.6	3.1	3.1	2.9	2.9	2.7	2.7	2.7	2.7	2.7
5	2.85	4.1	3.6	3.1	3.1	2.9	2.9	2.7	2.7	2.7	2.7	2.9
6	2.85	4.0	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.9
7	2.85	3.8	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.85
8	2.85	3.8	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.8
9	2.85	4.7	3.5	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.8
10	2.85	4.7	3.4	3.1	3.05	2.9	2.85	2.7	2.7	2.7	2.7	3.05
11	2.85	4.2	3.3	3.1	3.0	2.9	2.85	2.7	2.7	2.7	2.7	2.8
12	2.85	4.1	3.25	3.1	3.0	2.9	2.85	2.7	2.7	2.7	2.7	2.85
13	2.85	4.0	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.75
14	3.0	3.9	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.75
15	3.0	3.8	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.7
16	3.0	3.7	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.7
17	3.0	3.5	3.3	3.1	2.95	2.9	2.8	2.7	2.7	2.7	2.7	2.7
18	2.95	3.55	3.35	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
19	2.95	3.55	3.4	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.8
20	2.95	3.55	3.4	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
21	2.95	3.6	3.35	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
22	2.9	3.75	3.3	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
23	2.9	3.7	3.3	3.1	2.9	2.9	2.75	2.7	2.75	2.7	2.7	2.75
24	3.0	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.95	2.7	2.7	2.75
25	4.25	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.8	2.7	2.7	2.7
26	4.8	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.75	2.7	2.7	2.7
27	5.55	3.65	3.25	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
28	5.3	3.65	3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
29	3.85	3.75	3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
30	3.8		3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
31	3.65		3.2		2.9		2.75	2.7		2.7		2.7

Rating tables for Santa Ynez River near Lompoc, Cal.

NOVEMBER 10, 1906, TO JANUARY 7, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	8	5.50	114	6.00	320	6.50	750
5.10	23	5.60	146	6.10	380	6.60	870
5.20	42	5.70	182	6.20	450	6.70	1,010
5.30	64	5.80	224	6.30	540	6.80	1,170
5.40	88	5.90	270	6.40	640	6.90	1,330

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1906 and the form of the 1907–8 curve and is not well defined.

SEPTEMBER 25, 1907, TO DECEMBER 31, 1908.

2.70	18	3.50	790	4.30	2,320	5.10	4,080
2.80	44	3.60	950	4.40	2,540	5.20	4,300
2.90	90	3.70	1,120	4.50	2,760	5.30	4,520
3.00	155	3.80	1,300	4.60	2,980	5.40	4,740
3.10	240	3.90	1,480	4.70	3,200	5.50	4,960
3.20	350	4.00	1,680	4.80	3,420	5.60	5,180
3.30	480	4.10	1,890	4.90	3,640	5.70	5,400
3.40	630	4.20	2,100	5.00	3,860		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during 1907 and 1908 and is not well defined. Above gage height 4.2 feet the rating curve is a tangent, the difference being 220 per tenth.

Monthly discharge of Santa Ynez River near Lompoc, Cal., for 1906, 1907, and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1906.				
November 10-30	23	8	11.5	479
December	1,090	23	169	10,400
1907.				
January 1-7 [a]	1,330	224	442	6,140
October	555	30	114	7,010
November	197	67	90.5	5,390
December	122	67	76.8	4,720
1908.				
January	5,070	67	686	42,200
February	4,630	790	1,880	108,000
March	1,120	350	613	37,700
April	295	197	236	14,000
May	240	90	145	8,920
June	90	90	90	5,360
July	90	30	53.3	3,280
August	30	18	19.2	1,180
September	122	18	23.1	1,370
October	18	18	18	1,110
November	18	18	18	1,070
December	197	18	38.5	2,370
The year	5,070	18	318	227,000

[a] Discharges for January 8 and 9, estimated at approximately 42,000 and 62,000 second-feet, respectively, from an extension of the rating curve based on 1909 measurements.

NOTE.—Owing to shifting channel conditions and the small number of discharge measurements these are only approximate.

SALINAS RIVER DRAINAGE BASIN.[a]

DESCRIPTION.

The Salinas River basin lies almost wholly in Monterey and San Luis Obispo counties, and comprises an area about 4,780 square miles in extent, having a length of 150 miles northwest-southeast and a maximum width of about 45 miles.

The Salinas rises on the eastern slope of the Santa Lucia Range, near the southern end of the basin and flows northwestward, parallel to the coast, to its mouth, about 4 miles southwest of Castroville.

Topographically the Salinas basin is a long, narrow valley, walled in by steep mountain slopes which have been greatly eroded and dissected by stream action. At the northern end of the basin are the Gabilan Range and the Sierra de Salinas, separating it from the San Benito basin at the east and from Carmel River at the west; for the rest of its length it is flanked by parallel ridges on the west and by a broad mesa or elevated plain along the southeast, back of which are the crests of the Santa Lucia and Mount Diablo ranges respectively. The crest of the encircling mountains ranges in altitude from 2,500 to 4,000 feet above sea level. The rocks are sedimentary, resting on a basement complex of granite.

The forest cover in this basin is light and irregularly distributed. The valley has a few scattered trees and the eastern slopes are covered by grass, brush, and scrubby timber. On the higher elevations of the western slope there is considerable timber, most of which is included in a national forest reserve.

The mean annual precipitation is about 10 inches in the Salinas Valley, and increases with increase of altitude on the slopes. It is undoubtedly greatest on the west slope of the basin, where it probably ranges from 30 to 50 inches on the higher elevations and occurs almost entirely as rainfall.

The river has many tributaries, the most important of which, from north to south, are Arroyo Seco, San Antonio River, and Nacimiento River from the west and San Lorenzo and Estrella creeks from the east. The tributaries from the west are peculiar in that they lie west of secondary ranges parallel to the main range and flow southeastward for the greater part of their length, parallel but in a course directly opposite to the general course of Salinas River.

The streams of this basin are torrential and erratic, particularly the Salinas itself, which has a very heavy discharge in winter and no surface run-off in summer ordinarily except below Soledad. Some irrigation is carried on in the Salinas Valley, the water being obtained

[a] For a detailed discussion of the water resources of Salinas Valley see Water-Supply Paper 89.

from flowing streams and by pumping, but further development is feasible and very much needed.

There are several storage reservoir sites of more or less value on the tributaries of the Salinas River, some of which have already been surveyed.

Very little power could be developed continuously in the Salinas basin without storage.

The following stations have been maintained in this basin:

Salinas River near Salinas (1900 to 1901).
Nacimiento River at Byron (February to April, 1901).
San Antonio River at Jolon (December to April, 1901).
San Lorenzo Creek near Kings City (1901 to 1903).
Arroyo Seco near Soledad (1901 to 1908).

ARROYO SECO NEAR SOLEDAD, CAL.

Arroyo Seco, the most northern of the chief tributaries of Salinas River rises at an altitude of about 6,000 feet and flows southeastward to the mouth of its canyon; thence northeastward across gravel wash to its junction with Salinas River near Soledad. The western part of its basin is well covered with underbrush and trees of medium size, and is included in a forest reserve.

The mean annual precipitation probably ranges from 30 to 50 inches in the upper part of the basin, and occurs chiefly as rainfall. Several reservoir sites of more or less value for storage have already been surveyed in this basin.

The gaging station, which was established early in 1901 at Pettitt's ranch about 15 miles south of Soledad, has been maintained to determine the quantity of water available for storage and irrigation.

Several canals, diverting water below the station for irrigation in Salinas Valley, head above the broad wash of gravel and sand into which the low-water flow sinks and disappears and from which the stream receives the name Arroyo Seco.

The channel shifts more or less during high water, and the current is very swift. Measurements made at such stages may be considerably in error. Otherwise, the records are very good.

Discharge measurements of Arroyo Seco near Soledad, Cal., in 1907 and 1908.

[By Charles Pettitt.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	123	182	6.22	386	May 12	120	147	5.77	215
January 9	136	583	10.20	3,190	May 28	70	56	5.55	147
January 11	135	507	9.55	2,840	June 25	44	51	5.32	60
January 13	127	304	7.88	1,240	July 29	44	36	5.08	31
January 17	130	378	8.35	1,600	August 11	41	29	5.00	23
January 25	128	274	7.40	957	October 15	42	33	5.01	25
January 28	133	458	9.12	2,260	October 26	81	70	5.70	200
March 4	123	188	6.62	502					
March 5	126	261	7.55	915	1908.				
March 10	129	361	8.55	1,820	January 25	123	249	6.82	640
March 12	129	333	8.08	1,400	January 26	127	343	7.72	1,130
March 18	138	521	10.10	3,160	January 28	123	220	6.58	540
March 19	140	777	12.00	5,200	February 2	132	511	9.08	2,080
March 20	138	563	10.10	3,230	February 3	127	355	7.75	1,220
March 22	130	450	8.88	2,230	February 9	125	281	7.00	772
March 25	138	660	11.10	4,180	March 9 [a]	121	154	5.82	202
April 7	126	262	7.00	728	July 12	40	27	4.78	3.6
May 5	120	156	5.85	229	October 12	24	16	4.80	3.2

[a] Measurement by W. F. Martin.

Daily gage height, in feet, of Arroyo Seco near Soledad, Cal., for 1907 and 1908.

[Mrs. Charles Pettitt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.6	7.55	6.15	7.8	5.95	5.5	5.25	5.05	5.0	5.0	5.2	5.1
2	6.3	7.45	6.15	7.6	5.9	5.5	5.25	5.05	5.0	5.0	5.2	5.15
3	6.3	7.5	6.1	7.45	5.9	5.5	5.25	5.05	5.0	5.0	5.2	5.15
4	6.05	7.3	6.8	7.3	5.9	5.5	5.2	5.05	5.0	5.0	5.15	5.15
5	6.25	7.25	7.9	7.25	5.85	5.5	5.2	5.05	5.0	5.0	5.15	5.15
6	6.1	7.1	7.4	7.1	5.85	5.5	5.2	5.0	5.0	4.95	5.15	5.15
7	6.1	7.0	7.0	7.0	5.8	5.5	5.2	5.0	5.0	4.95	5.15	6.5
8	7.1	6.9	6.85	6.9	5.8	5.5	5.2	5.0	5.0	4.95	5.15	5.45
9	10.10	6.85	7.4	6.8	5.8	5.45	5.2	5.0	5.0	5.0	5.1	5.4
10	10.10	6.7	8.6	6.75	5.8	5.45	5.2	4.9	5.0	5.0	5.1	5.5
11	9.70	6.6	8.4	6.7	5.8	5.45	5.2	5.0	4.95	5.0	5.1	5.7
12	8.5	6.6	8.1	6.6	5.75	5.45	5.2	5.0	4.95	5.0	5.1	5.7
13	7.9	6.5	7.75	6.55	5.75	5.5	5.2	5.0	4.95	5.0	5.1	5.5
14	7.9	6.5	7.5	6.5	5.75	5.5	5.15	4.95	4.95	5.0	5.1	5.4
15	7.55	6.4	7.35	6.5	5.7	5.45	5.15	4.95	4.95	5.0	5.15	5.4
16	7.8	6.4	7.3	6.4	5.7	5.45	5.15	4.95	4.95	5.05	5.15	5.45
17	8.4	6.4	7.9	6.4	5.7	5.4	5.15	4.95	4.95	5.1	5.15	5.45
18	7.7	6.4	9.35	6.3	5.65	5.4	5.1	4.95	4.95	5.1	5.15	5.45
19	7.5	6.3	11.85	6.3	5.65	5.4	5.1	4.95	4.95	5.1	5.15	5.4
20	7.25	6.3	10.20	6.25	5.65	5.4	5.1	4.95	4.95	5.05	5.15	5.4
21	7.15	6.5	9.25	6.2	5.6	5.35	5.1	4.95	4.95	5.05	5.15	5.35
22	7.1	6.5	8.90	6.15	5.6	5.35	5.1	4.95	4.95	5.05	5.15	5.3
23	7.05	6.4	12.00	6.1	5.65	5.35	5.1	4.95	4.95	5.1	5.1	5.3
24	7.1	6.4	11.60	6.1	5.65	5.35	5.1	4.9	4.95	5.1	5.1	5.3
25	7.5	6.4	11.20	6.1	5.6	5.3	5.1	4.9	4.95	5.15	5.1	5.25
26	7.3	6.4	10.8	6.05	5.6	5.3	5.1	4.9	4.95	5.7	5.15	5.25
27	7.25	6.2	9.6	6.05	5.6	5.3	5.1	4.9	5.0	5.6	5.15	5.25
28	9.1	6.2	9.1	6.0	5.55	5.3	5.1	4.95	5.0	5.4	5.15	5.25
29	8.4	.....	8.6	6.0	5.55	5.3	5.1	4.95	5.0	5.3	5.1	5.25
30	8.0	.....	8.3	5.95	5.55	5.25	5.1	4.95	5.0	5.25	5.1	5.7
31	7.7	.....	7.9	.....	5.5	.....	5.05	5.0	.....	5.25	.....	5.75
1908.												
1	5.75	5.95	6.1	5.5	5.2	5.1	4.9	4.65	4.5	4.75	4.9	5.0
2	5.6	9.15	6.1	5.45	5.35	5.1	4.9	4.6	4.4	4.75	4.9	5.0
3	5.5	7.8	6.0	5.45	5.3	5.1	4.9	4.6	4.4	4.75	4.9	5.05
4	5.5	6.9	6.0	5.45	5.25	5.1	4.85	4.6	4.4	4.75	4.9	5.15
5	5.45	6.5	6.05	5.4	5.2	5.1	4.85	4.6	4.4	4.75	4.9	5.1

Daily gage height, in feet, of Arroyo Seco near Soledad, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	5.4	6.8	6.0	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
7	5.4	6.15	5.9	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
8	5.4	6.0	5.9	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
9	5.35	6.95	5.8	5.4	5.2	5.1	4.8	4.6	4.4	4.8	4.9	5.1
10	5.3	6.5	5.75	5.35	5.2	5.1	4.8	4.6	4.35	4.8	4.9	5.4
11	5.3	6.3	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.2
12	5.3	6.25	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.2
13	5.8	6.2	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.15
14	6.1	6.2	5.7	5.35	5.2	5.0	4.8	4.6	4.35	4.8	4.9	5.1
15	5.75	6.15	5.7	5.35	5.2	5.0	4.8	4.6	4.3	4.8	4.9	5.1
16	5.6	6.15	5.65	5.35	5.2	5.0	4.75	4.6	4.3	4.8	4.9	5.1
17	5.5	5.95	5.65	5.35	5.2	5.0	4.75	4.6	4.3	4.8	4.9	5.1
18	5.5	5.85	5.6	5.3	5.2	5.0	4.75	4.55	4.3	4.85	4.9	5.1
19	5.6	5.8	5.6	5.3	5.2	5.0	4.75	4.55	4.2	4.85	4.9	5.1
20	5.4	5.8	5.6	5.3	5.2	5.0	4.75	4.55	4.2	4.9	4.9	5.1
21	5.5	5.75	5.6	5.3	5.2	5.0	4.7	4.55	4.1	4.9	4.9	5.1
22	5.5	5.7	5.55	5.3	5.2	5.0	4.7	4.55	4.1	4.9	4.95	5.1
23	5.45	5.7	5.55	5.4	5.2	4.95	4.7	4.55	4.15	4.9	4.95	5.1
24	5.95	5.7	5.55	5.4	5.2	4.95	4.7	4.55	4.3	4.85	5.0	5.1
25	6.85	5.65	5.55	5.3	5.15	4.95	4.7	4.55	4.5	4.85	5.0	5.1
26	7.6	5.65	5.5	5.3	5.15	4.95	4.65	4.55	4.5	4.85	5.1	5.1
27	6.9	5.6	5.5	5.3	5.1	4.95	4.65	4.55	4.7	4.85	5.1	5.1
28	6.6	5.6	5.5	5.25	5.1	4.95	4.65	4.55	4.75	4.9	5.0	5.1
29	6.3	6.1	5.5	5.25	5.1	4.9	4.65	4.5	4.75	4.9	5.05	5.1
30	6.2	.....	5.5	5.2	5.1	4.9	4.65	4.5	4.75	4.9	5.0	5.1
31	6.0	.....	5.5	.....	5.1	.....	4.65	4.5	.....	4.9	.....	5.1

Rating table for Arroyo Seco near Soledad, Cal., for 1907 and 1908

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	0.5	5.80	216	7.10	760	8.80	2,000
4.60	1	5.90	250	7.20	815	9.00	2,180
4.70	2	6.00	285	7.30	870	9.20	2,365
4.80	4	6.10	320	7.40	925	9.40	2,555
4.90	11	6.20	355	7.50	980	9.60	2,745
5.00	21	6.30	395	7.60	1,040	9.80	2,935
5.10	33	6.40	435	7.70	1,105	10.00	3,125
5.20	47	6.50	475	7.80	1,175	10.20	3,320
5.30	64	6.60	520	7.90	1,250	10.40	3,520
5.40	88	6.70	565	8.00	1,330	10.60	3,720
5.50	118	6.80	610	8.20	1,490	10.80	3,920
5.60	150	6.90	660	8.40	1,655	11.00	4,125
5.70	183	7.00	710	8.60	1,825	12.00	5,175

NOTE.—This table is not applicable for obstructed-channel conditions. It is based upon 34 discharge measurements made during 1907 and 1908 and is well defined between gage heights 4.8 feet and 12 feet. Above gage height 11 feet the rating curve is a tangent, the difference being 105 per tenth.

Monthly discharge of Arroyo Seco near Soledad, Cal., for 1907 and 1908.

[Drainage area, 215 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	3,220	302	1,150	5.35	6.17	70,700	A.
February	1,010	355	568	2.64	2.75	31,500	A.
March	5,180	320	1,910	8.88	10.24	117,000	A.
April	1,180	268	529	2.46	2.74	31,500	A.
May	268	118	188	.874	1.01	11,600	A.
June	118	55	94.3	.439	.49	5,610	A.
July	55	27	40.3	.186	.21	2,480	B.
August	27	11	18.3	.090	.10	1,130	B.
September	21	16	18.3	.090	.10	1,090	B.
October	183	16	39.0	.184	.21	2,400	B.
November	47	33	38.1	.177	.20	2,270	B.
December	475	33	99.6	.463	.53	6,120	B.
The year	5,180	11	391	1.82	24.75	283,000	
1908.							
January	1,040	64	228	1.06	1.22	14,000	A.
February	2,320	150	416	1.93	2.08	23,900	A.
March	320	118	187	.870	1.00	11,500	A.
April	118	47	77.3	.360	.40	4,600	B.
May	76	33	46.0	.214	.25	2,830	B.
June	33	11	23.9	.111	.12	1,420	B.
July	11	1.5	4.2	.020	.02	258	C.
August	1.5	.5	.9	.0042	.005	55	D.
September	3	0	.4	.0018	.002	24	D.
October	11	3	6.2	.029	.03	381	C.
November	33	11	14.7	.068	.08	875	B.
December	88	21	35.2	.164	.19	2,160	B.
The year	2,320	0	86.6	.403	5.40	62,000	

SAN FRANCISCO BAY DRAINAGE.

GENERAL FEATURES.

The great central valley of California, including an area of about 64,000 square miles in extent lying between the Coast Range on the west and the Sierra Nevada on the east, is drained by two trunk streams. From the north comes the Sacramento; from the south the San Joaquin; both discharge their waters into Suisun Bay, whence they find outlet through Carquinez Strait and San Pablo Bay into San Francisco Bay, passing finally through the Golden Gate into the Pacific Ocean.

SACRAMENTO RIVER BASIN.

DESCRIPTION.

The area drained by the Sacramento and its tributaries extends from Suisun Bay northward to Mount Shasta and from Trinity Mountains and the Coast Range eastward to the Sierra Nevada. On the south it merges into the San Joaquin drainage basin. In general outline it is roughly elliptical, with a length of about 230 miles and a

width of about 150 miles. Its total area, including all tributaries, is approximately 27,100 square miles.

The Sacramento, the trunk stream of the basin, is the principal river in California. Rising in springs issuing from the western slope of Mount Shasta, the river flows almost due south for 370 miles and discharges into Suisun Bay about 50 miles by water above San Francisco. It is navigable as far north as Red Bluff, about 250 miles from its mouth.

The largest and most important tributaries of the Sacramento come from the east and include, in order from north to south, Pit River, Cow, Battle, Antelope, Mill, Deer, Chico, and Butte creeks and Feather and American rivers; from the west come Clear, Cottonwood, Thomes, Stony, Cache, and Puta creeks.

Considered as a whole, the basin is a region of rugged topography. Approximately 84 per cent of it is mountainous, and the other 16 per cent, comprising the gently sloping area along the lower reaches of the main stream, constitutes what is known as the Sacramento Valley.

The mountain ranges surrounding the basin belong to the Cordilleran system. The Sierra Nevada has an average width of approximately 70 miles from the rim of the valley to the crest of the range, which lies only a few miles west of the eastern boundary of the State. The range terminates in Warner Mountains in the northeastern part of the State, a region presenting evidence of recent volcanic action. Vast beds of lava cover the western slope of the range, and many cones, craters, ash deposits, and lakes exist in the vicinity of Mount Shasta and Lassen Peak, which are themselves the cones of extinct volcanoes. The Coast Range has an average width of approximately 35 miles from the rim of the valley to the crest, which lies inland from the shore and ranges in distance from 30 miles in the south to nearly 100 in the north, where the range takes the name Trinity Mountains. In Mount Shasta the Sierra Nevada and Coast Range merge into each other and also into the Cascade Range, which extends northward into Oregon.

The valley is in outline a long, narrow half ellipse, cut transversely, with its base opposite the mouth of the river. Its length north and south is approximately 150 miles, and its width varies from a few miles at the upper end near Red Bluff to 50 miles south of the city of Sacramento. The elevation of the valley ranges from 300 feet above sea level at Red Bluff to only a few feet at the mouth of the river. From the rim of the valley there is a slow rise in elevation across the zone of low-lying foothills, followed by a more rapid rise up the mountain side to the watershed on the summit of the encircling ranges. The eastern watershed ranges in elevation from 10,000 feet in the south to 6,000 or 7,000 in the north. The western watershed

ranges from 4,000 in the south to 9,000 in the north, and the northern from 4,000 to 8,000 feet, exclusive of Mount Shasta, which has an elevation of 14,380 feet.

The valley portion of the Sacramento basin has very little natural timber, but the fringe of undulating foothills supports a growth of brush and scrubby timber which, though sparsely distributed along the lower elevations, becomes much denser with increase of altitude. Beyond the foothill region the mountain slopes on all sides are well timbered, except in the northeastern portion of the basin, where large areas are barren. Practically all the public land in the timbered section of the basin has been included in federal forest reserves.

The mean annual precipitation in the basin varies with the altitude, being least on the valley floor where it averages 22 inches, and increases gradually up the mountain slopes, near whose summits an occasional maximum of 100 inches is attained. In the northeastern part of the basin, however, the annual precipitation is comparatively light, even at considerable elevations. The year is divisible into a well-defined "rainy season," extending from November to April, and an equally well-defined "dry season," lasting from May to October. The greater part of the annual rainfall comes in the winter months, particularly in December and January, when about 18 and 20 per cent, respectively, of the mean annual rainfall is received. February and March each bring about 13 per cent and November 12 per cent, so that about 76 per cent of the mean annual rainfall is received in the period November to March, inclusive. During April, May, and October, 20 per cent more is received. The other four months are practically rainless. At the higher altitudes the precipitation appears chiefly in the form of snow during the late fall, winter, and early spring months. Ordinarily the snow melts slowly and does not completely disappear until late summer, thus prolonging and equalizing the stream flow. Occasionally the snow line extends below the 2,000-foot contour for short periods, thus giving rise to conditions which may result in disastrous floods in the valley if the temperature rises rapidly and is accompanied by heavy rain. Such a combination of conditions produces floods of greater or less severity in the winter or spring of almost every year. Ice does not form in any of the streams except in the high mountains far above the gaging stations, so that the stream-flow records in this basin are not affected by ice conditions.

The possibilities for irrigation in this basin are great. The Sacramento Valley probably furnishes the greatest field for development in the United States.

Existing development in irrigation has been achieved along the lines of individual and corporate private enterprise on a small scale.

Some water is diverted from practically all the streams entering the valley and applied to the irrigation of small scattered areas. Several irrigation districts have been formed at different times, but they have generally proved unsuccessful. The United States Reclamation Service has made preliminary investigations in the valley, and is now engaged in the construction of the Orland reclamation unit which will supply about 14,000 acres on the west side of Sacramento River.

The Sacramento basin contains many excellent storage sites, a number of which have already been surveyed by the Reclamation Service.

The possibilities for water-power development in the Sacramento basin are almost unlimited. Fully 50 per cent of all the available water power in the State exists in this basin, though its area is not more than 17 per cent that of the State. A number of the streams have a fall of 4,000 or 5,000 feet and an average minimum flow of several hundred second-feet. Without storage they are capable of developing a minimum of 2,000,000 horsepower, and with storage about 3,000,000 horsepower. The development at the present time is approximately 110,000 horsepower.

Large perennial springs are numerous in the northeastern part of the Sacramento basin, many of them discharging more than 100 second-feet and a few of them several hundred. Nearly all these springs have their sources in the lava beds covering this part of the basin. They are very effective in equalizing the mean monthly stream flow throughout the year and in maintaining a good minimum flow in the fall.

The streams of this basin have such heavy gradients as to make them generally unsuited for use in logging. Some logging, however, is done on Sacramento and Pit rivers.

The longest run-off record in this basin is that of Sacramento River, which runs back to 1895. The longest record of any of the tributaries extends back as far as 1901. The wettest year was 1904 and the driest was 1898. The greatest recorded flood flow, however, was in March, 1907. The total flow during the wettest year was about four times that of the driest. The mean average monthly flow is greatest in March and smallest in September, the ratio being about 1 to 13.

Investigations of flow have been made on Sacramento River and on the following tributaries:

Pit River.
McCloud River.
Cottonwood Creek.
Stony Creek.
Cache Creek.
Puta Creek.
Feather River.
Yuba River.
Bear River.
American River.

Gaging stations have been maintained on the main stream as follows:

Sacramento River at Jellys Ferry, near Red Bluff (1895 to 1902).
Sacramento River at Iron Canyon, near Red Bluff (1902 to 1908).

SACRAMENTO VALLEY.

Sacramento Valley, whose possibilities for general development through a comprehensive system of reclamation makes it by far the most important area in the basin, lies along the lower course of Sacramento River for a distance of about 150 miles northward from its mouth. Except for Marysville Buttes, in its center, the valley has a gentle and quite uniform slope, ranging from approximately 4 feet to the mile in the north to less than half a foot in the south. It is intensely fertile, has a semitropical climate and good transportation facilities, and lies near large centers of population. The valley as a whole suffers from an excess of water at one season and a deficiency at another. The problem of remedying these defects embraces three distinct phases—the preservation and improvement of navigation, the reclamation of swamp and overflowed lands, and the development of irrigation for all the higher lands. The general problem is undoubtedly the largest and most difficult in the field of hydraulic engineering in the West, but it seems only a question of time until it must be solved, because the interests involved are so important.

The valley suffers from frequent floods, which occur in winter or early spring. The worst floods in recent years occurred in 1904, 1907, and 1909. Each succeeding flood seems to cause more damage in proportion to the volume of water, due partly to the fact that there is more property to be damaged and partly to the effect of débris in the river channels. From 1849 to 1880 enormous quantities of débris arising from hydraulic mining were deposited in the upper courses of several of the streams on the eastern slope of the Sacramento basin. This mining débris, together with the large quantities of natural débris brought down by all the streams during flood, has resulted in elevating the stream beds and consequently the flood plane. The result is that all the streams now occupy ridges and have large overflow basins.

The lower course of Sacramento River for a distance of about 100 miles occupies a ridge from 5 to 20 feet higher than the troughs of the nearly parallel flood basins on each side, which are from 2 to 7 miles from the river. These big flood basins, Colusa and Yolo on the west side, and Butte, Sutter, and American on the east side, have a total area of approximately 900 square miles. They have a combined storage capacity equivalent to three days' continuous flood flow of all the streams discharging into the valley, and are, therefore,

very powerful in affecting flood stages. When full, the combined capacity of these basins is sufficient to cover the entire valley to a depth of 1.38 feet.

The total area of the Sacramento Valley is about 4,250 square miles, divided approximately as follows: Two thousand five hundred and ten square miles of high lands not subject to overflow, but requiring irrigation for successful farming; 450 square miles of lower lands overflowed occasionally; 1,250 square miles of low lands overflowed periodically, and submerged for a considerable part of the year; and 38 square miles of perennial stream surface. It is thus seen that about 40 per cent of the valley suffers from floods and about 60 per cent from drought.

MAIN SACRAMENTO RIVER.

SACRAMENTO RIVER NEAR RED BLUFF, CAL.

This station, which is located at the lower end of Iron Canyon about 4 miles above Red Bluff and about 3 miles by river below the proposed Iron Canyon dam site, was established January 28, 1902, to take the place of a station at Jellys Ferry, about 12 miles above Red Bluff, which had been maintained since April 30, 1895.

The observations at this point furnish general statistical data concerning the flow of Sacramento River and are useful in connection with the maintenance of navigation below Red Bluff and in the consideration of reclamation problems in Sacramento Valley.

No important tributaries enter within several miles of the station, above or below. Antelope and Redbank creeks come in about 7 miles and Mill Creek about 16 miles below the station. Paines Creek enters about 3 miles and Battle and Cottonwood creeks about 10 miles above the station. Pit River enters about 40 miles above and Feather River about 100 miles below.

No diversions of any kind are made above the station, and it is believed that no appropriations of nor filings on water have been made.

The flow at the station is not affected by artificial storage. No change has been made in the gage datum since the station was established. The channel section is practically permanent and the station is well rated. The records are thoroughly reliable.

Discharge measurements of Sacramento River near Red Bluff, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	R. S. Hawley	546	7,640	8.95	35,200
February 23	do	548	7,700	9.10	36,100
March 7	do	542	6,880	7.65	28,800
April 2	W. G. Steward	555	8,060	10.20	37,400
April 24	do	540	6,210	6.70	21,200
May 5	do	528	5,520	5.10	16,400
May 14	do	527	5,310	4.70	14,900
June 20	W. F. Martin	523	4,480	3.47	10,200
September 10	W. A. Lamb	499	3,770	1.70	5,950
October 15	do	495	3,750	1.70	5,570
1908.					
February 27	W. A. Lamb	510	4,920	3.80	12,800
September 25	W. V. Hardy	497	3,430	1.20	4,230
December 18	W. F. Martin	493	3,760	1.70	6,270

Daily gage height, in feet, of Sacramento River near Red Bluff, Cal., for 1907 and 1908.

[Richard Groebe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.85	15.45	8.5	.....	5.4	3.95	2.8	2.0	1.7	1.6	1.9	1.85
2	4.55	21.2	7.5	10.2	5.4	3.9	2.7	2.0	1.8	1.6	1.95	1.85
3	4.8	20.4	7.0	10.2	5.25	3.8	2.7	2.0	1.8	1.6	1.95	1.85
4	14.45	23.1	6.5	9.7	5.2	3.85	2.7	1.95	1.8	1.6	1.9	1.9
5	10.85	18.35	6.9	10.3	5.1	3.7	2.65	1.95	1.8	1.6	1.85	2.1
6	6.95	16.3	7.8	11.15	5.05	3.6	2.6	1.95	1.8	1.6	1.85	2.2
7	5.5	13.95	7.6	11.7	5.0	3.7	2.55	1.95	1.8	1.6	1.85	3.7
8	5.3	11.7	7.1	10.8	4.9	3.6	2.5	1.95	1.75	1.6	1.85	3.5
9	5.9	9.6	7.9	10.2	4.8	3.5	2.5	1.95	1.7	1.6	1.8	2.7
10	5.95	8.95	9.7	9.9	4.85	3.35	2.5	1.95	1.7	1.6	1.8	2.7
11	5.25	8.1	9.75	9.8	5.25	3.95	2.5	1.95	1.7	1.65	1.8	4.9
12	4.7	7.35	9.3	9.55	5.15	7.45	2.4	1.95	1.7	1.65	1.8	3.25
13	4.3	6.9	8.1	9.3	4.85	6.75	2.3	1.95	1.7	1.7	1.8	3.3
14	4.3	6.4	7.3	9.3	4.7	4.6	2.3	1.9	1.7	1.7	1.8	3.45
15	4.15	6.1	6.8	9.15	4.6	4.0	2.3	1.9	1.7	1.7	1.8	2.9
16	3.85	5.85	6.6	8.8	4.6	3.8	2.3	1.9	1.7	1.7	1.8	2.7
17	4.1	6.0	10.0	8.4	4.55	3.7	2.25	1.85	1.7	1.7	1.8	2.5
18	4.1	6.3	21.4	7.9	4.5	3.6	2.25	1.85	1.7	1.65	1.8	2.4
19	3.9	5.85	26.05	7.7	4.9	3.5	2.25	1.8	1.7	1.7	1.8	2.3
20	3.8	5.7	28.7	7.6	5.2	3.4	2.2	1.8	1.65	1.7	1.85	3.3
21	3.75	5.6	22.85	7.0	4.7	3.4	2.2	1.8	1.65	1.7	1.85	2.7
22	3.75	6.35	18.4	7.0	4.4	3.3	2.2	1.8	1.65	1.7	1.85	2.4
23	3.75	8.85	21.65	6.9	4.45	3.2	2.15	1.8	1.65	1.7	1.85	2.5
24	3.8	7.65	16.8	6.7	4.2	3.15	2.15	1.8	1.65	1.7	1.85	2.55
25	4.5	13.1	14.3	6.4	4.15	3.0	2.1	1.75	1.65	1.8	1.85	2.6
26	5.2	10.8	13.25	6.4	4.1	3.0	2.1	1.75	1.6	1.8	1.85	10.6
27	5.35	9.0	12.15	6.25	4.05	3.0	2.1	1.75	1.6	1.8	1.85	8.0
28	10.7	8.0	10.5	6.0	4.0	2.9	2.1	1.75	1.6	1.85	1.85	4.4
29	12.15	.....	.....	5.8	4.0	2.9	2.05	1.75	1.6	1.9	1.85	4.0
30	10.55	.....	.....	5.6	3.95	2.8	2.05	1.7	1.6	2.1	1.85	4.65
31	9.9	.....	.....	.....	3.9	.....	2.05	1.7	.....	2.15	.....	7.35
1908.												
1	8.8	7.5	5.4	3.4	3.5	2.8	1.9	1.4	1.2	1.25	1.6	1.7
2	6.1	11.6	5.55	3.3	4.25	2.7	1.85	1.4	1.2	1.25	1.55	1.65
3	4.8	8.3	5.3	3.3	3.75	2.7	1.8	1.35	1.2	1.25	1.5	1.65
4	7.0	6.3	5.55	3.3	3.5	2.6	1.8	1.35	1.2	1.25	1.5	1.9
5	4.95	9.7	5.6	3.3	3.4	2.55	1.75	1.3	1.2	1.25	1.5	3.3
6	4.25	8.95	4.9	3.3	3.25	2.55	1.75	1.3	1.2	1.25	1.5	2.5
7	3.75	8.8	4.6	3.3	3.25	2.55	1.75	1.3	1.2	1.25	1.45	2.1
8	3.4	8.8	4.35	3.25	3.4	2.6	1.7	1.3	1.2	1.25	1.45	1.95
9	3.5	17.15	4.25	3.2	3.15	2.55	1.7	1.3	1.2	1.25	1.45	2.35
10	3.4	11.1	4.2	3.3	3.1	2.6	1.7	1.3	1.2	1.25	1.45	2.2

Daily gage height, in feet, of Sacramento River near Red Bluff, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	3.3	8.15	4.2	3.5	3.1	2.6	1.65	1.3	1.2	1.25	1.45	2.0
12	3.2	6.7	4.3	3.7	3.15	2.55	1.65	1.3	1.2	1.25	1.45	1.9
13	3.4	5.9	4.4	3.85	3.0	2.5	1.6	1.3	1.2	1.3	1.45	1.85
14	11.35	5.35	4.6	3.9	2.95	2.4	1.6	1.3	1.2	1.3	1.45	1.85
15	6.6	4.95	4.7	3.9	3.5	2.4	1.6	1.25	1.25	2.7	1.5	1.85
16	5.4	4.75	5.05	4.15	3.2	2.4	1.6	1.25	1.2	1.8	1.5	1.8
17	4.7	4.5	5.2	4.05	3.05	2.3	1.55	1.25	1.3	1.5	1.45	1.75
18	4.8	4.35	5.2	3.8	3.1	2.2	1.55	1.25	1.3	1.5	1.45	1.7
19	7.75	4.2	5.0	3.7	5.05	2.1	1.5	1.25	1.3	1.5	1.5	1.65
20	11.5	4.0	4.7	3.95	3.8	2.1	1.5	1.25	1.3	1.5	1.5	1.6
21	9.4	3.9	4.5	4.1	3.6	2.35	1.5	1.25	1.3	1.5	2.35	1.6
22	7.55	3.8	4.3	4.05	3.5	2.2	1.5	1.25	1.3	1.45	3.2	1.6
23	6.4	3.7	4.2	4.1	3.4	2.1	1.45	1.25	1.25	1.45	3.3	1.7
24	10.0	3.7	4.15	4.4	3.3	2.1	1.45	1.25	1.2	1.45	2.7	2.0
25	7.9	3.7	4.25	4.4	3.2	2.0	1.45	1.25	1.2	1.4	2.2	2.0
26	6.45	3.7	4.25	4.1	3.25	2.0	1.4	1.25	1.2	1.4	2.15	1.8
27	5.6	3.85	4.05	3.8	3.15	1.9	1.4	1.25	1.2	1.45	1.95	1.75
28	5.1	4.0	3.9	3.7	3.05	1.9	1.4	1.25	1.25	1.45	1.8	1.8
29	4.6	4.2	3.7	3.6	3.0	1.9	1.4	1.25	1.25	1.45	1.75	1.8
30	4.3	.....	3.6	3.55	2.9	1.9	1.4	1.2	1.25	1.7	1.75	1.8
31	4.05	.....	3.5	.....	2.8	.....	1.4	1.2	.....	1.95	.....	1.75

Rating table for Sacramento River near Red Bluff, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	3,980	2.70	8,600	5.00	16,620	15.00	68,200
1.00	4,200	2.80	8,910	5.20	17,390	16.00	75,100
1.10	4,420	2.90	9,220	5.40	18,170	17.00	82,200
1.20	4,650	3.00	9,540	5.60	18,970	18.00	89,700
1.30	4,880	3.10	9,860	5.80	19,780	19.00	97,600
1.40	5,110	3.20	10,190	6.00	20,600	20.00	105,900
1.50	5,350	3.30	10,520	6.20	21,440	21.00	114,600
1.60	5,590	3.40	10,860	6.40	22,290	22.00	123,700
1.70	5,840	3.50	11,200	6.60	23,150	23.00	133,200
1.80	6,090	3.60	11,540	6.80	24,020	24.00	143,100
1.90	6,350	3.70	11,890	7.00	24,900	25.00	153,500
2.00	6,610	3.80	12,240	8.00	29,400	26.00	164,500
2.10	6,880	3.90	12,590	9.00	34,100	27.00	176,000
2.20	7,150	4.00	12,940	10.00	39,000	28.00	187,500
2.30	7,430	4.20	13,660	11.00	44,200	29.00	199,500
2.40	7,710	4.40	14,380	12.00	49,700		
2.50	8,000	4.60	15,120	13.00	55,600		
2.60	8,300	4.80	15,860	14.00	61,700		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 58 discharge measurements made during 1902–1908 and is well defined between gage heights 1 foot and 21 feet. It is the same as the 1906 table between gage heights 10.5 and 20.3 feet. This curve averages all measurements made at this station and as the channel is permanent is applicable from 1902 to 1909.

Monthly discharge of Sacramento River near Red Bluff, Cal., for 1907 and 1908.

[Drainage area, 9,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	64,600	12,100	21,500	2.31	2.66	1,320,000	A.
February	134,000	19,000	45,400	4.88	5.08	2,520,000	A.
March	196,000	22,700	55,700	5.99	6.91	3,420,000	A.
April	48,000	19,000	32,200	3.46	3.86	1,920,000	A.
May	18,200	12,600	15,500	1.67	1.92	953,000	A.
June	26,900	8,910	12,200	1.31	1.46	726,000	A.
July	8,910	6,740	7,550	.812	.94	464,000	A.
August	6,610	5,840	6,260	.673	.78	385,000	A.
September	6,090	5,590	5,830	.627	.70	347,000	A.
October	7,020	5,590	5,870	.631	.73	361,000	A.
November	6,480	6,090	6,200	.667	.74	369,000	A.
December	42,100	6,220	11,600	1.25	1.44	713,000	A.
The year	196,000	5,590	18,800	2.02	27.22	13,500,000	
1908.							
January	47,000	10,200	21,000	2.26	2.61	1,290,000	A.
February	83,300	11,900	23,200	2.49	2.68	1,330,000	A.
March	19,000	11,200	15,000	1.61	1.86	922,000	A.
April	14,400	10,200	11,900	1.28	1.43	708,000	A.
May	16,800	8,910	10,700	1.15	1.33	658,000	A.
June	8,910	6,350	7,560	.813	.91	450,000	A.
July	6,350	5,110	5,570	.599	.69	342,000	A.
August	5,110	4,650	4,830	.519	.60	297,000	A.
September	4,880	4,650	4,710	.506	.56	280,000	A.
October	8,600	4,760	5,230	.562	.65	322,000	A.
November	10,500	5,230	6,060	.652	.73	361,000	A.
December	10,500	5,590	6,370	.685	.79	392,000	A.
The year	83,300	4,650	10,200	1.09	14.84	7,350,000	

PIT RIVER DRAINAGE BASIN.

DESCRIPTION.

The Pit River basin lies in the northeastern part of California, chiefly in Modoc, Lassen, and Shasta counties. Its area is about 5,980 square miles, exclusive of Goose Lake drainage, which, though topographically tributary to the Pit basin, has no discharging outlet. Physically the Pit basin is not tributary to the larger Sacramento basin, but is really its upper extension under a different name, having about 22 per cent of the total area of the Sacramento basin.

Pit River has its source in Warner Mountains at an elevation of 9,900 feet, and flows southwestward. Its length is about 180 miles, and it has a total fall of nearly 6,000 feet. It empties into Sacramento River, or rather the upper Sacramento empties into it, in the western part of Shasta County near Kennett, about 20 miles north of Redding.

The principal tributaries of Pit River are McCloud River, Squaw Creek, and Fall River from the north, and Burney, Hat, Beaver, Ash, and West Valley creeks from the south. McCloud and Fall rivers are the largest, having a minimum flow of 1,200 to 1,500 second-feet. Hat and Burney creeks also have a minimum flow of several hundred second-feet.

McCloud River drains an area comprising 649 square miles, lying just east of the upper Sacramento basin and including that part of the Pit basin which is fed directly from Mount Shasta. It has a length north and south of approximately 50 miles, and a width ranging from a few miles in the south to 20 miles or more in the north. The river rises in large springs in the lava formation southeast of Mount Shasta, but its main water supply comes directly from the southern and eastern slopes of Mount Shasta through Squaw, Mud, Cold, and Ash creeks, which are its chief tributaries. The river flows southward, has a length of about 60 miles and a fall of more than 4,000 feet. It discharges into Pit River about 4 miles east of the confluence of Sacramento and Pit rivers.

The greater portion of the Pit River basin exceeds 4,000 feet in elevation, and consists for the most part of barren lava beds in the north and numerous small, flat, marshy meadow valleys in the south. The area also contains many volcanic buttes and peaks, of which Mount Shasta in the north, with elevation of 14,380 feet above sea level, and Lassen Peak in the south, with elevation of 10,437 feet, are the most important. These are, however, on the Pit basin divide, and are common to the upper Sacramento and Feather basins, respectively.

About 50 per cent of the Pit basin is devoid of forestation, the timberless area lying chiefly in the northern and eastern parts. There are two well-forested areas in the basin—the one south of Pit River and north of Lassen Peak, and the other north of Pit River and South of Mount Shasta, extending from Fall River westward to the upper Sacramento and including the McCloud basin. All the public land in the forested areas is included in federal forest reserves.

The precipitation in Pit River region is very unevenly distributed. In the upper eastern part of the basin it is only about 10 inches annually and occurs largely as snow, which at moderate altitudes soon melts. In the western and northwestern parts, however, the mean annual precipitation amounts to 50 and even 75 inches, according to altitude, and occurs principally as rain except on the upper slopes of Mount Shasta, Lassen Peak, and other high peaks. In the McCloud basin it is seldom less than 40 inches and occasionally reaches 100 inches. Practically all the precipitation is confined to the "rainy season," from November to April of each year. There is not enough ice during the winter season to interfere with stream-flow records.

This basin affords little opportunity for irrigation. The valleys are many but are, as a rule, small and more or less swampy, and find use chiefly for meadow lands and for the growing of stock feed. Some of them are flooded artificially for the raising of wild hay, but such flooding can not be properly called irrigation. The uplands have a light soil covering and are used only for domestic pasturage and general stock-raising, which is carried on extensively.

The storage possibilities in Pit River basin are very great. Numerous reservoir sites on the upper reaches of the Pit and its tributaries have been surveyed by the United States Reclamation Service. A reservoir at the Big Valley site near Bieber would store more water than the river furnishes at this point. Warm Spring reservoir at Canby would also have a large storage capacity.

The possibilities for power development in this basin are also great, especially below Fall River Mills, which is about halfway between the source and mouth of Pit River. It is estimated that Fall River could develop more than 30,000 and McCloud River more than 200,000 horsepower continuously. Hat Creek could develop about 100,000 and Burney Creek about 10,000 continuously. Pit River and tributaries could develop about 1,000,000 horsepower continuously. About 50 per cent of this amount is commercially feasible of development, and only about 2 per cent has been developed.

Many perennial springs issue from crevices in the lava formation and some of them have a flow of several hundred second-feet. Fall River is fed from one or two large springs about 10 miles above its mouth, which discharge 1,500 second-feet. Hat and Burney creeks are fed largely from springs on the northern slope of Lassen Peak. McCloud River draws heavily from numerous large springs on the southern slope of Mount Shasta. Most of the smaller tributaries are also fed by springs.

The longest run-off record in this basin runs back to 1902. The wettest year in this period was 1904 and the driest was 1908. The total run-off during the wettest year was about twenty times greater than that during the driest year.

The following gaging stations have been maintained in this river basin:

Pit River near Canby (1904 to 1905).
Pit River near Bieber (1904 to 1908).
South Fork Pitt River near Ivy (1904 to 1905).
West Valley Creek near Likely (1904 to 1905).
Ash Creek at Adin (1904 to 1905).
McCloud River near Gregory (1902 to 1908).

PIT RIVER NEAR BIEBER, CAL.

This station, which is located about 12 miles south of Bieber, in the gorge near the dam site at the lower end of Big Valley, was established January 22, 1904, to determine the quantity of water available for storage in the proposed Big Valley reservoir, and it was discontinued September 30, 1908.

No large tributaries enter Pit River near the station. Ash Creek comes in from the east about 16 miles above, and Beaver Creek enters from the south at Pittville, about 12 miles below. Fall River, one of the chief tributaries, enters about 15 miles below the station.

No diversions are made immediately above the station. A large part of the flow of the stream, however, is undoubtedly lost by evaporation from the surface of the numerous swampy valleys through which the stream flows. Many of the valleys are flooded artificially during the summer season.

Many filings on water and applications for rights of way over public lands in this basin have been made. Most of the rights, however, have not been improved.

The stream is under no artificial control above or below the station that will affect the accuracy of the records. The channel conditions, however, are not the best. The bed is rocky and rough, though not subject to change, and the current is very sluggish at low stages. No change in the gage datum has been made. The records are fairly reliable.

Discharge measurements of Pit River near Bieber, Cal., for 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	F. H. Holabird	180	595	4.30	646
January 31	do	220	1,080	6.80	3,360
February 6	do	220	1,010	6.50	2,780

Daily gage height, in feet, of Pit River near Bieber, Cal., for 1907 and 1908.

[F. H. Holabird, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.0	7.3	6.4	6.8	5.6	4.6	4.6	3.0	2.25	2.4	3.55	3.9
2	5.0	9.6	6.3	6.7	5.3	4.6	4.6	2.95	2.3	2.4	3.6	3.9
3	4.8	10.1	6.1	6.6	5.1	5.0	4.5	2.95	2.3	2.4	3.6	3.9
4	4.6	10.5	6.3	6.6	5.0	5.1	4.4	2.9	2.3	2.4	3.6	3.9
5	4.4	10.7	6.55	6.5	4.9	5.6	4.3	2.8	2.35	2.4	3.5	3.9
6	4.3	10.35	6.9	6.5	4.9	5.6	4.1	2.8	2.35	2.4	3.5	3.95
7	4.1	9.0	7.0	6.5	4.85	5.9	3.9	2.8	2.35	2.4	3.4	4.0
8	4.0	8.4	7.0	6.6	4.8	6.1	3.9	2.8	2.3	2.4	3.4	4.1
9	4.0	7.55	6.8	6.6	4.8	6.8	3.8	2.8	2.3	2.4	3.4	4.3
10	3.8	7.0	6.8	6.7	4.8	6.85	3.8	2.9	2.3	2.45	3.4	4.5
11	3.8	6.5	6.6	7.0	4.9	6.9	3.7	2.8	2.3	2.45	3.4	4.6
12	3.8	6.2	6.4	7.0	5.0	7.0	3.75	2.7	2.3	2.45	3.4	4.6
13	3.7	5.9	6.2	7.0	5.1	6.8	3.7	2.6	2.35	2.5	3.45	4.6
14	3.7	5.8	6.1	7.0	5.2	6.9	3.6	2.5	2.35	2.5	3.5	4.7
15	3.8	5.7	.....	7.0	5.0	6.9	3.5	2.45	2.35	2.55	3.55	4.9
16	3.9	5.5	.....	6.9	4.9	6.95	3.4	2.4	2.35	2.55	3.6	4.95
17	3.7	5.6	12.8	6.9	4.9	6.8	3.35	2.4	2.35	2.6	3.65	5.0
18	3.5	5.9	15.5	6.9	4.9	6.7	3.3	2.3	2.35	2.7	3.7	5.0
19	3.4	6.4	16.4	6.8	4.9	6.6	3.35	2.3	2.35	2.8	3.7	5.0
20	3.3	6.1	.....	6.75	4.8	6.4	3.4	2.3	2.35	2.8	3.75	4.95
21	3.4	6.0	.....	6.7	4.8	6.1	3.5	2.25	2.35	2.9	3.8	4.95
22	3.5	5.75	.....	6.8	4.8	6.0	3.4	2.25	2.3	3.0	3.85	4.9
23	3.5	6.0	9.7	6.9	4.8	5.8	3.35	2.25	2.3	3.1	3.9	4.85
24	3.6	6.1	8.5	6.4	4.8	5.6	3.35	2.25	2.3	3.2	4.0	4.8
25	3.7	6.4	7.4	6.3	4.9	5.6	3.3	2.3	2.3	3.35	4.0	4.8
26	4.1	6.7	.....	6.25	4.95	5.2	3.3	2.35	2.35	3.5	4.0	4.7
27	4.3	6.6	.....	6.2	5.0	4.8	3.2	2.4	2.35	3.5	4.0	4.65
28	4.9	6.4	.....	6.1	5.0	4.6	3.1	2.4	2.4	3.5	3.95	4.6
29	6.2	.....	.....	6.0	4.95	4.6	3.0	2.25	2.4	3.5	3.9	4.55
30	6.5	.....	.....	5.7	4.8	4.6	3.0	2.25	2.4	3.55	3.9	4.5
31	6.8	.....	.....	.....	4.7	.....	3.0	2.25	.....	3.55	.....	4.4

Daily gage height, in feet, of Pit River near Bieber, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.4	3.5	3.1	3.4	2.35	3.05	.....	2.0	.....	.....	.....	.....
2	4.4	3.6	3.1	3.3	2.4	3.0	.....	2.0	1.45	1.5	.....	.....
3	4.3	3.8	3.15	3.2	2.4	3.0	.....	1.95	1.4	.....	.....	.....
4	4.2	3.95	3.15	3.1	2.4	2.9	.....	1.9	1.4	.....	.....	.....
5	3.9	4.2	3.2	3.0	2.4	2.95	.....	1.8	1.4	2.0	3.0	.....
6	4.0	4.5	3.3	2.9	2.35	2.8	.....	1.7	.....	2.5	.....	.....
7	4.2	4.7	3.4	2.8	2.3	2.7	.....	1.6	.....	.....	.....	.....
8	4.8	4.6	3.5	2.7	2.2	2.6	2.75	1.65	1.4	.....	2.8	.....
9	5.2	4.5	3.6	2.6	2.1	2.5	2.8	1.5	1.45	.....	.....	.....
10	5.5	4.4	3.7	2.5	2.0	2.5	2.8	1.5	1.45	.....	.....	.....
11	5.6	4.2	3.8	2.45	2.0	2.8	2.75	1.5	1.5	.....	.....	.....
12	5.7	4.1	3.9	2.45	2.3	2.7	2.75	.....	1.5	.....	.....	.....
13	5.8	4.0	4.0	2.3	2.4	2.5	2.75	.....	1.5	.....	2.95	.....
14	5.9	3.8	4.0	2.1	2.5	2.5	2.75	1.5	1.45	.....	.....	.....
15	5.6	3.6	4.0	2.0	2.5	2.5	2.7	1.5	1.4	.....	.....	.....
16	5.4	.....	4.0	2.0	2.6	2.5	2.7	1.5	1.4	.....	.....	.....
17	5.3	.....	4.0	2.4	2.7	2.5	2.6	1.5	1.45	.....	.....	.....
18	5.2	3.2	4.0	2.5	2.8	2.5	2.5	1.45	.....	.....	.....	.....
19	5.0	3.1	4.0	2.6	2.8	2.5	2.5	1.4	.....	.....	.....	.....
20	4.8	3.1	4.0	2.4	2.9	2.5	2.45	1.45	1.45	.....	.....	.....
21	4.5	3.1	4.0	2.35	2.95	2.5	2.45	1.45	1.45	.....	.....	.....
22	4.2	3.0	4.0	2.35	2.95	2.5	2.45	1.5	1.45	.....	.....	.....
23	4.0	3.0	4.0	2.4	3.0	2.5	2.3	1.5	1.45	.....	.....	.....
24	3.7	3.0	4.0	2.5	3.05	2.5	2.2	1.5	1.45	.....	.....	.....
25	3.4	3.0	3.9	2.5	3.05	2.8	2.1	1.5	1.45	.....	.....	.....
26	3.3	3.0	3.8	2.5	3.05	2.95	2.0	.....	1.45	.....	.....	.....
27	3.3	3.0	3.6	2.5	3.05	2.95	1.95	.....	1.45	.....	.....	.....
28	3.3	3.0	3.5	2.4	3.05	2.9	2.0	1.45	.....	.....	.....	.....
29	3.3	3.1	3.4	2.35	3.05	2.8	2.0	1.45	.....	.....	.....	.....
30	3.3	.....	3.4	2.3	3.05	2.7	2.0	1.45	1.45	.....	.....	.....
31	3.4	.....	3.4	.....	3.05	.....	2.0	1.45	.....	.....	.....	.....

Rating table for Pit River near Bieber, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	4	3.00	120	4.50	755	7.00	3,520
1.50	6	3.10	135	4.60	825	7.20	3,840
1.60	9	3.20	154	4.70	900	7.40	4,160
1.70	13	3.30	177	4.80	980	7.60	4,480
1.80	18	3.40	205	4.90	1,060	7.80	4,820
1.90	23	3.50	240	5.00	1,140	8.00	5,180
2.00	29	3.60	276	5.20	1,320	9.00	7,140
2.10	35	3.70	316	5.40	1,500	10.00	9,600
2.20	41	3.80	356	5.60	1,700	11.00	12,400
2.30	49	3.90	400	5.80	1,900	12.00	15,200
2.40	57	4.00	450	6.00	2,120	13.00	18,000
2.50	66	4.10	500	6.20	2,360	14.00	20,800
2.60	76	4.20	560	6.40	2,630	15.00	23,600
2.70	86	4.30	620	6.60	2,920	16.00	26,400
2.80	96	4.40	685	6.80	3,220	17.00	29.200
2.90	108						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on fifty-six discharge measurements made during 1906 and 1907, and is fairly well defined between gage heights 2.0 feet and 8.0 feet. Above gage height 10.0 feet the rating curve is a tangent, the difference being 280 per tenth. Above gage height 1.90 it is the same as the 1906 table.

Monthly discharge of Pit River near Bieber, Cal., for 1907 and 1908.

[Drainage area, 2,950 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	3,220	177	710	2.41	0.28	43,700	B.
February	11,600	1,600	4,190	1.42	1.48	233,000	B.
March	27,500	2,240	6,940	2.35	2.71	427,000	B.
April	3,520	1,800	2,970	1.01	1.13	177,000	B.
May	2,230	900	1,130	.383	.44	69,500	B.
June	3,520	825	2,160	.732	.82	129,000	B.
July	825	120	323	.109	.13	19,900	B.
August	120	45	71.7	.024	.03	4,410	B.
September	57	45	51.5	.017	.02	3,060	B.
October	258	57	113	.038	.04	6,950	B.
November	450	205	307	.104	.12	18,300	B.
December	1,140	400	799	.271	.31	49,100	B.
The year	27,500	45	1,650	.558	7.51	1,180,000	
1908.							
January	2,010	177	861	.292	.34	52,900	B.
February	900	120	339	.115	.12	19,500	B.
March	450	135	322	.109	.13	19,800	B.
April	205	29	77.6	.026	.029	4,620	B.
May	127	29	83.3	.028	.032	5,120	B.
June	127	66	85.6	.029	.032	5,090	B.
July	96	26	68.3	.023	.026	4,200	B.
August	29	5	9.3	.0032	.004	572	C.
September	6	4	4.8	.0016	.002	286	C.
The period						112,000	

McCLOUD RIVER NEAR GREGORY, CAL.

This station, which was established March 23, 1902, in cooperation with the McCloud River Electric Company, for the purpose of collecting general statistical data regarding the flow of the stream, is located at John's camp, near Hirze Mountain, by road about 14 miles east of Gregory post-office, which is on the upper Sacramento, just opposite Baird railroad station. The gaging station is 12 or 15 miles above the United States fishery at Baird post-office, near the mouth of the river. The station was discontinued June 30, 1908.

No important tributaries enter below the station, which is only about 15 miles above the mouth, and no diversions have been made either above or below. Filings on water for power development and applications for rights of way over public lands have been made, and conflicting rights are still unadjudicated. The flow is not affected by artificial conditions above or below the station.

The location and datum of the gage have not been changed.

The results at moderate stages are reasonably accurate. No discharge measurements were made during 1907 or 1908.

Daily gage height, in feet, of McCloud River near Gregory, Cal., for 1907 and 1908.

[F. P. Ackerson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.6	7.35	3.35	3.9	2.9	2.4	1.9	1.7	1.6	1.55	1.6	1.55
2	2.4	9.1	3.15	4.2	2.8	2.4	1.9	1.7	1.6	1.55	1.55	1.55
3	2.55	7.6	2.95	4.05	2.8	2.35	1.9	1.7	1.6	1.55	1.55	1.55
4	4.4	7.6	2.8	4.0	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.6
5	3.2	6.5	2.9	4.05	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.55
6	2.95	6.7	3.05	4.3	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.7
7	2.9	5.15	2.9	4.55	2.7	2.3	1.9	1.7	1.6	1.55	1.55	2.1
8	2.55	4.4	2.9	4.45	2.7	2.3	1.85	1.7	1.6	1.55	1.55	2.7
9	2.15	4.0	3.05	4.5	2.7	2.2	1.85	1.75	1.6	1.55	1.55	2.6
10	2.0	3.65	3.3	4.6	2.7	2.2	1.85	1.7	1.6	1.55	1.55	2.7
11	2.0	3.35	3.65	4.6	2.95	2.5	1.85	1.7	1.6	1.55	1.55	2.2
12	2.0	3.2	3.4	4.65	2.8	2.45	1.8	1.7	1.6	1.55	1.55	1.9
13	2.0	3.1	3.15	4.55	2.6	2.3	1.8	1.7	1.6	1.55	1.55	2.2
14	2.0	2.5	2.95	4.5	2.6	2.2	1.8	1.65	1.6	1.55	1.55	1.8
15	1.9	2.9	2.8	4.3	2.55	2.2	1.8	1.65	1.6	1.55	1.55	1.8
16	1.9	2.8	2.8	4.05	2.5	2.15	1.8	1.65	1.6	1.55	1.55	1.7
17	1.85	2.9	4.0	3.8	2.55	2.1	1.8	1.65	1.6	1.55	1.55	1.7
18	1.85	2.9	9.4	3.7	2.55	2.05	1.8	1.65	1.6	1.55	1.55	1.6
19	1.85	2.8	12.0	3.7	3.0	2.05	1.8	1.65	1.6	1.55	1.55	1.6
20	1.8	2.7	10.65	3.6	2.9	2.05	1.8	1.65	1.6	1.55	1.55	1.6
21	1.75	2.7	7.5	3.5	2.7	2.0	1.8	1.65	1.6	1.55	1.55	1.6
22	1.7	2.95	5.9	3.4	2.7	2.0	1.8	1.65	1.6	1.55	1.55	1.6
23	1.7	3.15	5.5	3.4	2.5	2.0	1.75	1.65	1.6	1.55	1.55	1.6
24	1.8	3.5	4.9	3.4	2.5	2.0	1.75	1.65	1.6	1.55	1.55	1.6
25	2.0	5.1	4.55	3.3	2.45	2.0	1.75	1.6	1.6	1.55	1.55	1.6
26	2.0	4.5	3.95	3.3	2.4	2.0	1.75	1.6	1.6	1.6	1.55	2.35
27	2.2	3.85	3.8	3.2	2.4	1.95	1.75	1.6	1.55	1.65	1.55	2.2
28	4.2	3.6	3.8	3.2	2.4	1.95	1.7	1.6	1.55	1.6	1.55	1.9
29	6.2	.....	3.75	3.0	2.4	1.95	1.7	1.6	1.55	1.6	1.55	1.95
30	4.9	.....	3.7	2.9	2.4	1.95	1.7	1.6	1.55	1.65	1.55	2.4
31	8.65	.....	3.7	.....	2.4	.....	1.7	1.6	.....	1.6	.....	3.1
1908.												
1	3.0	2.1	2.7	2.2	2.5	2.0	.....	.....	.....	.....	.....	.....
2	2.6	2.1	2.75	2.1	2.5	2.0	.....	.....	.....	.....	.....	.....
3	2.3	2.1	2.65	2.1	2.4	2.0	.....	.....	.....	.....	.....	.....
4	2.4	2.15	2.4	2.2	2.4	1.9	.....	.....	.....	.....	.....	.....
5	2.25	2.35	2.3	2.2	2.3	1.95	.....	.....	.....	.....	.....	.....
6	2.1	3.5	2.2	2.2	2.25	1.95	.....	.....	.....	.....	.....	.....
7	1.9	4.25	2.2	2.2	2.35	1.95	.....	.....	.....	.....	.....	.....
8	1.9	3.75	2.1	2.15	2.3	1.95	.....	.....	.....	.....	.....	.....
9	1.9	4.1	2.1	2.2	2.3	1.9	.....	.....	.....	.....	.....	.....
10	1.9	3.6	2.25	2.3	2.2	1.9	.....	.....	.....	.....	.....	.....
11	1.85	3.1	2.4	2.4	2.1	1.9	.....	.....	.....	.....	.....	.....
12	1.85	2.8	2.45	2.5	2.1	1.9	.....	.....	1.2	.....	.....	.....
13	1.95	2.55	2.45	2.6	2.1	1.9	.....	.....	1.2	.....	.....	.....
14	2.95	2.4	2.5	2.65	2.3	1.9	.....	.....	1.2	.....	.....	.....
15	2.8	2.4	2.65	2.8	2.2	1.9	.....	.....	1.2	.....	.....	.....
16	2.35	2.3	2.85	2.9	2.2	1.9	.....	.....	1.2	.....	.....	.....
17	2.2	2.2	3.05	2.8	2.1	1.8	.....	.....	1.3	.....	.....	.....
18	2.55	2.15	2.95	2.6	2.25	1.8	.....	.....	1.3	.....	.....	.....
19	3.4	2.1	2.75	2.7	2.3	1.8	.....	.....	1.35	.....	.....	.....
20	4.95	2.1	2.6	2.85	2.2	1.85	.....	.....	1.35	.....	.....	.....
21	4.6	2.1	2.6	2.8	2.2	1.8	.....	.....	1.3	.....	.....	.....
22	3.2	2.1	2.6	2.75	2.2	1.8	.....	.....	1.3	.....	.....	.....
23	2.75	2.05	2.6	2.8	2.15	1.75	.....	.....	1.3	.....	.....	.....
24	2.75	2.0	2.6	2.8	2.15	1.7	.....	.....	1.3	.....	.....	.....
25	2.6	2.0	2.55	2.8	2.2	1.7	.....	.....	1.3	.....	.....	.....
26	2.5	2.05	2.55	2.7	2.15	1.7	.....	.....	1.3	.....	.....	.....
27	2.4	2.2	2.4	2.6	2.15	1.7	.....	.....	1.3	.....	.....	.....
28	2.25	2.35	2.4	2.5	2.1	1.6	.....	.....	1.3	.....	.....	.....
29	2.2	2.5	2.3	2.5	2.1	1.6	.....	.....	1.3	.....	.....	.....
30	2.1	.....	2.3	2.5	2.1	1.6	.....	.....	1.3	.....	.....	.....
31	2.05	.....	2.25	.....	2.0	.....	.....	.....	.....	.....	.....	.....

Rating table for McCloud River near Gregory, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	1,178	2.90	2,578	4.60	5,410	6.60	10,350
1.30	1,228	3.00	2,700	4.70	5,625	6.80	10,920
1.40	1,282	3.10	2,825	4.80	5,840	7.00	11,500
1.50	1,340	3.20	2,955	4.90	6,060	7.20	12,100
1.60	1,402	3.30	3,090	5.00	6,280	7.40	12,710
1.70	1,468	3.40	3,230	5.10	6,500	7.60	13,330
1.80	1,538	3.50	3,380	5.20	6,730	7.80	13,960
1.90	1,612	3.60	3,535	5.30	6,960	8.00	14,600
2.00	1,690	3.70	3,695	5.40	7,200	8.20	15,260
2.10	1,772	3.80	3,860	5.50	7,440	8.40	15,930
2.20	1,858	3.90	4,030	5.60	7,680	8.60	16,610
2.30	1,948	4.00	4,210	5.70	7,930	8.80	17,300
2.40	2,042	4.10	4,395	5.80	8,180	9.00	18,000
2.50	2,140	4.20	4,585	5.90	8,440	10.00	21,700
2.60	2,242	4.30	4,785	6.00	8,700	11.00	25,700
2.70	2,349	4.40	4,990	6.20	9,240	12.00	30,000
2.80	2,461	4.50	5,200	6.40	9,790		

NOTE.—The table is not applicable for obstructed-channel conditions. It is based on seventeen discharge measurements made during 1902–1906, and is fairly well defined between gage heights 1.5 feet and 6.0 feet.

Below gage height 5.1 feet it is the same as the table for 1902 to 1906.

Monthly discharge of McCloud River near Gregory, Cal., for 1907 and 1908.

[Drainage area, 608 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	16,800	1,470	2,880	4.74	5.46	177,000	A.
February	18,400	2,140	5,510	9.06	9.43	306,000	A.
March	30,000	2,460	6,000	9.87	11.38	369,000	A.
April	5,520	2,580	4,100	6.74	7.52	244,000	A.
May	2,640	2,040	2,290	3.77	4.35	141,000	A.
June	2,140	1,650	1,840	3.03	3.38	109,000	A.
July	1,610	1,470	1,550	2.55	2.94	95,300	A.
August	1,500	1,400	1,440	2.37	2.73	88,500	A.
September	1,400	1,370	1,400	2.30	2.57	83,300	A.
October	1,440	1,370	1,380	2.27	2.62	84,800	A.
November	1,400	1,370	1,370	2.25	2.51	81,500	A.
December	2,820	1,370	1,660	2.73	3.15	102,000	A.
The year	30,000	1,370	2,620	4.31	58.04	1,880,000	
1908.							
January	6,170	1,580	2,300	3.78	4.36	141,000	A.
February	4,680	1,690	2,280	3.75	4.04	131,000	A.
March	2,760	1,770	2,150	3.54	4.08	132,000	A.
April	2,580	1,770	2,170	3.57	3.98	129,000	A.
May	2,140	1,690	1,880	3.09	3.56	116,000	A.
June	1,690	1,400	1,570	2.58	2.88	93,400	A.
The period						742,000	
September 12–30	1,260	1,180	1,220	2.01	1.42	46,000	A.

NOTE.—This station was discontinued June 30, 1908. September gage heights taken on account of extreme low-water conditions.

COTTONWOOD CREEK DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Cottonwood Creek lies west of Sacramento River and east of the Coast Range and just south of Clear Creek drainage basin.

Cottonwood Creek has three principal forks, called North, Middle, and South or Cold forks. North Fork rises in Bully Choop Mountain, which has an elevation of 7,073 feet above sea level. It is about 20 miles long, drains an area of 112 square miles, and has total fall about 4,200 feet. It unites with Middle Fork a short distance below Gas Point. Middle Fork is about 30 miles long, has a fall of 5,900 feet, and drains an area of 261 square miles. South Fork rises in Yallo Bally Mountains which reaches an elevation of about 6,000 feet, and unites with the main creek a few miles west of the town of Cottonwood. It is about 45 miles long, drains an area of 395 square miles, and has a fall of 4,600 feet. The main creek flows eastward and empties into the Sacramento about 5 miles east of the town of Cottonwood and opposite the mouth of Battle Creek. The total drainage area is 929 square miles.

The crest of the Coast Range, which forms the western boundary of the basin for a distance of about 50 miles, ranges in elevation from 6,000 to 8,000 feet above sea level. From the crest toward the east the basin slopes rapidly to the foothills around the northern end of the Sacramento Valley, and is regularly furrowed by numerous drainage ways. About two-thirds of the area is more than 1,000 feet above sea level.

This basin is very well timbered, but at the lower elevations the growth is more or less scrubby. The upper part of the basins of Middle and South forks is included in the Trinity National Forest.

The mean annual precipitation ranges from 25 inches in the lower part, where it occurs as rainfall, to more than 50 inches along the crest of the Coast Range, where much of it occurs as snow.

Some irrigation on a small scale is carried on in this basin, especially in the northern part along the North Fork, and there is opportunity for further development.

Storage is undoubtedly possible in the basin, but to what extent is not known. The same may be said regarding power development.

Only one gaging station has been maintained in the basin. This station is on the North Fork at Ono, 1907 to 1908.

NORTH FORK OF COTTONWOOD CREEK AT ONO, CAL.

This station was established October 27, 1907, at the highway bridge one-fourth mile west of Ono, for the purpose of determining the amount of water available above Ono for further irrigation development.

Several small ditches divert water from the creek above the gaging station. In September, 1908, they carried a total of 14 second-feet. Acquired water rights greatly exceed the low-water flow. The channel is somewhat rough and subject to slight change. At high stages the current is swift and is somewhat obstructed by the center bridge pier. The datum of the gage has not been changed.

The following miscellaneous discharge measurements were made of canals which divert water from Cottonwood Creek above the gaging station at Ono, Cal.:

Miscellaneous discharge measurements of canals diverting water from Cottonwood Creek.

Date.	Canal.	Locality.	Discharge.
1908.			*Sec.-ft.*
September 26	Bee Creek Ditch Co	1 mile below intake	1.3
September 27	Happy Valley Land and Water Co	1½ miles below intake	6.2
Do	Jerusalem	½ mile below intake	2.1
Do	Marina Gold Mining Co	¾ mile below intake	[a] 4.1

[a] This water is used for power development and is returned to creek channel.

Discharge measurements of North Fork of Cottonwood Creek at Ono, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 28	W. A. Lamb	26	15	4.45	13
1908.					
February 1	W. A. Lamb	88	101	5.45	246
February 20	do	90	112	5.31	212
March 12	do	90	98	5.30	206
April 22	do	48	62	5.10	124
September 26	W. V. Hardy	6	5.6	4.20	5.3
December 19	W. F. Martin	37	29	4.59	28

Daily gage height, in feet, of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908.

[F. J. Wheelock, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1		4.4	4.4	11		4.4	4.95	21		4.4	4.8
2		4.5	4.4	12		4.4	5.15	22		4.45	4.8
3		4.4	4.4	13		4.4	5.2	23		4.45	4.8
4		4.4	4.5	14		4.4	4.95	24		4.4	4.8
5		4.4	4.5	15		4.4	4.9	25		4.4	4.85
6		4.4	4.55	16		4.4	4.8	26		4.4	6.4
7		4.4	5.15	17		4.4	4.8	27		4.4	5.45
8		4.4	4.8	18		4.4	4.8	28	4.4	4.4	5.25
9		4.4	4.7	19		4.4	5.15	29	4.4	4.4	5.2
10		4.4	5.5	20		4.4	4.95	30	4.4	4.4	5.3
								31	4.4		5.75

Daily gage height, in feet, of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5.35	5.45	5.4	5.2	5.1	4.75	4.4	4.1	4.0	4.2	4.4	4.5
2	5.3	6.1	5.3	5.2	5.2	4.7	4.4	4.1	4.05	4.2	4.4	4.5
3	5.25	5.6	5.3	5.15	5.1	4.7	4.35	4.1	4.05	4.2	4.4	4.5
4	5.3	5.5	5.3	5.15	5.1	4.7	4.35	4.1	4.1	4.2	4.4	4.7
5	5.2	5.65	5.3	5.15	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.7
6	5.15	5.95	5.3	5.15	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.6
7	5.1	5.95	5.3	5.1	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.6
8	5.1	6.05	5.3	5.1	5.0	4.65	4.35	4.1	4.1	4.2	4.4	4.6
9	5.1	7.05	5.25	5.1	5.0	4.65	4.3	4.1	4.1	4.2	4.4	4.85
10	5.1	6.15	5.25	5.1	5.0	4.6	4.25	4.1	4.1	4.2	4.4	4.7
11	5.1	5.85	5.25	5.1	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.65
12	5.1	5.7	5.3	5.15	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.6
13	5.35	5.6	5.3	5.15	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.6
14	5.35	5.55	5.3	5.15	5.0	4.6	4.3	4.2	4.15	4.55	4.4	4.6
15	5.25	5.5	5.3	5.2	5.0	4.55	4.3	4.2	4.15	4.6	4.4	4.6
16	5.2	5.5	5.35	5.2	5.0	4.55	4.3	4.1	4.2	4.5	4.4	4.6
17	5.2	5.45	5.4	5.2	5.0	4.55	4.25	4.05	4.4	4.4	4.4	4.55
18	5.75	5.4	5.4	5.15	5.0	4.5	4.25	4.05	4.3	4.4	4.4	4.55
19	5.6	5.4	5.4	5.15	5.0	4.55	4.2	4.0	4.3	4.4	4.4	4.55
20	5.9	5.3	5.3	5.15	5.0	4.55	4.2	4.0	4.3	4.4	4.6	4.55
21	5.7	5.3	5.3	5.1	4.95	4.55	4.2	4.0	4.25	4.4	4.6	4.55
22	5.55	5.3	5.3	5.2	4.9	4.55	4.2	4.0	4.2	4.4	4.7	4.55
23	5.5	5.3	5.3	5.3	4.9	4.5	4.15	4.0	4.2	4.4	4.65	4.6
24	6.55	5.3	5.3	5.25	4.9	4.5	4.2	4.0	4.2	4.4	4.6	4.55
25	5.75	5.3	5.3	5.25	4.9	4.5	4.1	4.0	4.2	4.4	4.75	4.55
26	5.6	5.35	5.3	5.2	4.85	4.5	4.1	4.0	4.2	4.4	4.6	4.55
27	5.5	5.4	5.25	5.15	4.8	4.5	4.1	4.0	4.2	4.4	4.5	4.55
28	5.5	5.4	5.25	5.1	4.7	4.4	4.1	4.05	4.2	4.4	4.5	4.55
29	5.4	5.4	5.2	5.1	4.7	4.4	4.1	4.0	4.2	4.4	4.5	4.55
30	5.4	.....	5.2	5.1	4.75	4.4	4.1	4.0	4.2	4.55	4.5	4.55
31	5.4	.....	5.2	.....	4.75	.....	4.1	4.0	.....	4.5	.....	4.55

Rating table for North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	4	4.90	76	5.70	380	6.50	960
4.20	5	5.00	98	5.80	435	6.60	1,060
4.30	7	5.10	124	5.90	495	6.70	1,160
4.40	11	5.20	154	6.00	560	6.80	1,270
4.50	18	5.30	190	6.10	630	6.90	1,380
4.60	28	5.40	230	6.20	705	7.00	1,500
4.70	41	5.50	275	6.30	785	7.10	1,620
4.80	57	5.60	325	6.40	870		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1907 to 1909 and is well defined between gage heights 4.2 feet and 6.7 feet.

Monthly discharge of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908.

[Drainage area, 52 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
November	18	11	11.4	0.219	0.24	678	A.
December	870	11	125	2.40	2.68	7,690	A.
1908.							
January	1,010	124	254	4.88	5.63	15,600	A.
February	1,560	190	361	6.94	7.48	20,800	A.
March	230	154	189	3.63	4.18	11,600	A.
April	190	124	142	2.73	3.05	8,450	A.
May	154	41	91.2	1.75	2.02	5,610	A.
June	49	11	26.8	.515	.57	1,590	A.
July	11	4	6.5	.125	.14	400	A.
August	5	3	3.6	.069	.08	221	A.
September	11	3	4.8	.092	.10	286	A.
October	28	5	10.5	.202	.23	646	A.
November	49	11	17.2	.331	.37	1,020	A.
December	66	18	27.5	.529	.61	1,690	A.
The year	1,560	3	94.5	1.82	24.46	67,900	

NOTE.—Several small canals divert water from Cottonwood Creek above the gaging station. Discharge measurements made during September, 1908, show a total of 14 second-feet diverted.

STONY CREEK DRAINAGE BASIN.

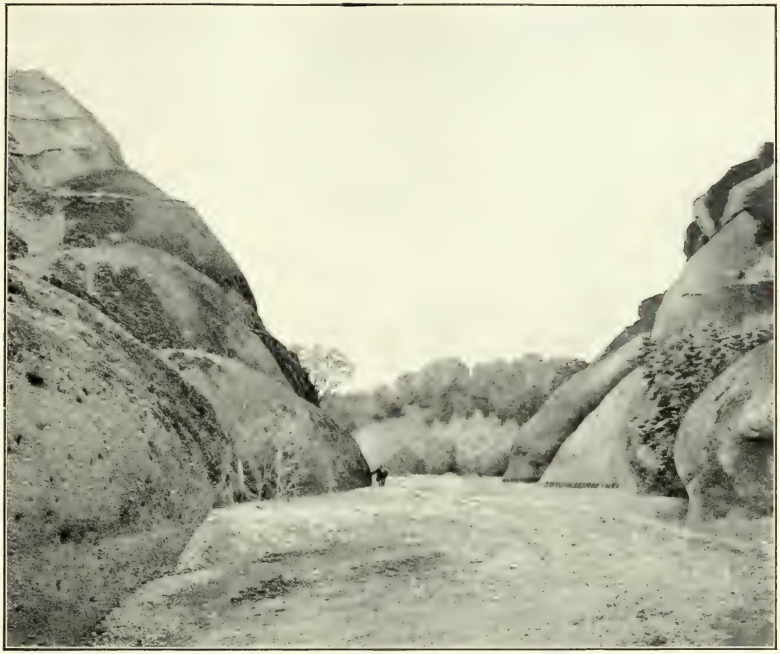
DESCRIPTION.

The Stony Creek drainage basin lies on the eastern slope of the Coast Range, north of the Cache Creek drainage basin, and south of the Thomes Creek basin, which lies between it and the Cottonwood basin on the north. The total drainage area of Stony Creek is about 828 square miles. Of this area about 600 square miles is embraced in an irregular parallelogram 10 to 15 miles in width and touching the crest of the range for a distance of 50 or 60 miles.

The creek rises in the south end of this area and flows northward along its eastern border for a distance of about 35 miles, then westward for about 15 miles, and finally southeastward to its junction with the Sacramento near St. John. The total length of the creek is about 90 miles, and its fall about 4,000 or 5,000 feet.

The principal tributaries of Stony Creek are Little Stony Creek from the south end of the area, Briscoe Creek from its middle, Grindstone Creek from its north end; and North Fork, which enters the main creek about 10 miles northwest of Orland.

The drainage basin of Stony Creek is somewhat peculiar topographically and geologically. The main stream lies wholly in sedimentary rock; the tributaries from the west come from the granitic crest of the range, and have heavy gradients. At various points in the basin the streams intersect conglomerate ridges of more or less hardness, which, because of their resistance to erosion, have produced



A. EAST PARK DAM SITE ON LITTLE STONY CREEK.

B. STONY CREEK GAGING STATION, NEAR FRUTO.

favorable sites for dams and reservoirs. The basin ranges in elevation from a few hundred feet in the valley to 6,000 feet or more at the summit of the range.

This basin is covered with a good forest growth of grass and dense brush at the lower elevations and heavy commercial timber on the mountain summits. About three-fourths of the upper basin is included in a national forest reserve.

The mean annual precipitation varies from 18 inches in the valley to 40 inches or more on the mountain summits, where more or less of it occurs as snowfall. The worst freshets occur during the winter.

For years Stony Creek has been used as a source of water for irrigation on a small scale in the northeastern part of Glenn County. The United States Reclamation Service now has under construction the Orland reclamation unit, which will furnish water to 14,000 acres around Orland. The water will be taken from Stony Creek by the aid of several dams for storage and diversion.

Storage possibilities in this basin are good. (See Pl. IV, *A*.) The most important reservoir sites on the main stream and its tributaries were surveyed several years ago by the Geological Survey. For the result of these surveys see Water-Supply Paper 86.

Without storage only a comparatively small quantity of power could be developed continuously in Stony Creek basin; but, with a comprehensive storage system, many thousand horsepower could be developed.

The run-off record on Stony Creek runs back to 1901. The wettest year since that time was 1907 and the driest 1908, or possibly 1901. Early in 1909, however, the maximum daily flow greatly exceeded all previous records. The total flow for the wettest year was a little more than double that for the driest.

Gaging stations have been maintained in this basin as follows:

Stony Creek near Fruto (1901 to 1908).
Little Stony Creek near Lodoga (1907 to 1908).

STONY CREEK NEAR FRUTO, CAL.

This station, which is located at Julian's ranch, about 7 miles northwest of Fruto, and 1¾ miles above the Mill Site dam site, which is in sec. 1, T. 21 N., R. 6 W., Mount Diablo base and meridian, was established January 30, 1901, to determine the quantity of water available for storage at the dam site below.

The only important tributary near the gaging station is Grindstone Creek, which has a drainage area of 173 square miles, and which enters from the west a short distance above the station. Still farther south of (above) the station, Salt, Elk, and Briscoe creeks enter. North Fork Stony Creek, which has a drainage area of about 90 square miles, enters about 12 miles below the station.

The channel is composed of gravel which shifts more or less during high water, when the current is very swift and the stream is several hundred feet wide. (See Pl. IV, *B*.) The gage datum has remained unchanged.

The records are fair except for very high stages. Estimates for flood flow are more or less approximate.

Discharge measurements of Stony Creek near Fruto, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 11	R. S. Hawley	143	333	6.35	1,430
April 26	W. G. Steward	138	274	5.95	895
June 12	L. F. Hendricks	134	156	5.05	274
August 1	T. H. Humphreys	78	64	4.30	27
September 12	W. A. Lamb	38	33	4.25	19
1908.					
January 2	W. A. Lamb	133	204	5.68	615
January 11	do	133	208	5.65	621
January 14	do	144	369	6.65	1,710
February 4	do	145	316	6.10	1,360
February 7	do	150	471	6.75	2,520
February 10	do	153	529	7.25	2,870
February 19	do	138	253	5.75	890
February 26	do	138	278	5.83	986
March 1	do	150	384	6.35	1,560
March 3	do	140	254	5.90	925
March 11	do	138	238	5.73	770
June 3	J. L. Rhead	67	99	4.78	225
June 6	do	90	104	4.71	164
June 10	do	82	115	4.70	166

Daily gage height, in feet, of Stony Creek near Fruto, Cal., for 1907 and 1908.

[W. H. Julian, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.8	9.85	6.0	7.35	5.6	5.2	4.6	4.2	4.2	4.3	4.3	4.4
2	4.8	12.4	5.9	7.2	5.6	5.1	4.6	4.2	4.2	4.3	4.3	4.4
3	4.8	11.35	5.8	7.1	5.6	5.1	4.5	4.2	4.2	4.3	4.3	4.4
4	9.45	11.0	5.7	7.0	5.5	5.1	4.5	4.2	4.2	4.3	4.3	4.4
5	6.35	10.0	7.6	6.9	5.5	5.1	4.5	4.2	4.2	4.3	4.3	4.4
6	6.1	9.3	7.4	7.15	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.8
7	6.0	8.6	6.75	7.25	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.6
8	6.35	8.2	6.5	7.2	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.5
9	9.15	7.4	7.15	7.05	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.5
10	9.0	6.75	6.75	6.9	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.5
11	7.1	6.5	6.5	6.8	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.2
12	6.3	6.4	6.4	6.7	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.1
13	5.8	6.3	6.3	6.6	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.6
14	5.55	6.3	6.2	6.5	5.4	5.1	4.4	4.2	4.2	4.3	4.4	5.2
15	5.4	6.2	6.1	6.6	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.1
16	5.4	6.1	6.0	6.5	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.0
17	5.6	6.2	9.45	6.5	5.3	4.9	4.3	4.2	4.2	4.3	4.4	5.0
18	5.55	6.1	14.25	6.5	5.3	4.9	4.3	4.2	4.2	4.3	4.4	4.9
19	5.65	6.1	13.15	6.5	5.4	4.9	4.3	4.2	4.2	4.3	4.4	4.9
20	6.0	6.0	11.8	6.4	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.2
21	6.65	6.0	9.8	6.4	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.1
22	6.8	6.25	7.75	6.3	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.0
23	6.8	6.4	11.55	6.3	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.9
24	6.7	6.3	8.7	6.2	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.9
25	6.7	6.2	8.15	6.1	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.8

Daily gage height, in feet, of Stony Creek near Fruto, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	6.8	6.35	7.75	6.0	5.3	4.7	4.3	4.2	4.3	4.3	4.4	7.5
27	8.15	6.1	7.45	5.9	5.3	4.7	4.3	4.2	4.3	4.3	4.4	6.85
28	7.65	6.0	7.25	5.8	5.2	4.7	4.3	4.2	4.3	4.3	4.4	6.4
29	7.2	.....	7.25	5.7	5.2	4.7	4.3	4.2	4.3	4.3	4.4	6.5
30	6.85	.....	7.35	5.6	5.2	4.6	4.3	4.2	4.3	4.3	4.4	7.65
31	7.6	.....	7.35	.....	5.2	.....	4.3	4.2	.....	4.3	.....	7.0
1908.												
1	5.85	6.55	6.8	5.4	5.2	5.0	4.4	4.1	3.9	4.1	4.3	4.5
2	5.65	8.8	6.15	5.4	5.2	5.0	4.4	4.1	3.9	4.1	4.3	4.5
3	5.55	6.8	5.9	5.4	5.2	4.9	4.4	4.1	3.9	4.1	4.3	4.5
4	5.65	6.15	5.8	5.4	5.2	4.9	4.4	4.1	3.9	4.1	4.3	4.6
5	5.5	6.65	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.4
6	5.4	7.55	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.1
7	5.3	6.7	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.0
8	5.2	6.5	5.8	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.0
9	6.25	10.15	5.8	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.4	5.0
10	6.0	7.1	5.9	5.4	5.2	4.8	4.3	4.1	3.9	4.1	4.4	5.1
11	5.9	6.7	5.9	5.4	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.2
12	5.8	6.35	5.95	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.1
13	5.7	6.15	5.95	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.0
14	6.6	6.0	6.05	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	4.9
15	6.05	5.9	6.05	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	4.8
16	5.85	5.9	6.15	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.4	4.7
17	5.65	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.7
18	5.75	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
19	5.55	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
20	7.9	5.7	6.0	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
21	6.85	5.7	6.0	5.3	5.2	4.6	4.2	4.0	4.0	4.2	4.75	4.6
22	6.75	5.7	5.9	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.6	4.6
23	6.65	5.6	5.9	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.6
24	7.8	5.5	5.8	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.6
25	6.9	5.5	5.8	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.5
26	6.35	5.4	5.7	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
27	6.05	5.4	5.7	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
28	5.9	5.4	5.6	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
29	5.8	5.4	5.6	5.3	5.0	4.5	4.2	4.0	4.0	4.3	4.5	4.5
30	5.7	.....	5.5	5.3	5.0	4.5	4.2	4.0	4.1	4.3	4.5	4.5
31	5.6	.....	5.5	.....	5.0	.....	4.2	4.0	.....	4.3	.....	4.5

Rating tables for Stony Creek near Fruto, Cal.

MARCH 8, 1906, TO FEBRUARY 1, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	380	5.90	1,150	7.00	2,390	8.20	3,980
4.90	430	6.00	1,250	7.10	2,515	8.40	4,280
5.00	480	6.10	1,355	7.20	2,640	8.60	4,606
5.10	530	6.20	1,460	7.30	2,765	8.80	4,930
5.20	580	6.30	1,570	7.40	2,890	9.00	5,270
5.30	640	6.40	1,680	7.50	3,020	9.20	5.630
5.40	705	6.50	1,790	7.60	3,150	9.40	6,000
5.50	780	6.60	1,905	7.70	3,286	9.60	6,400
5.60	865	6.70	2,020	7.80	3,410	9.80	6,800
5.70	955	6.80	2,140	7.90	3,550	10.00	7,280
5.80	1,050	6.90	2,265	8.00	3,690		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made during 1906 and three during 1904, and is well defined below gage height 6.4 feet.

Rating tables for Stony Creek near Fruto, Cal.—Continued.

FEBRUARY 2 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	15	5.60	580	7.00	2,160	8.80	4,860
4.30	30	5.70	660	7.10	2,300	9.00	5,200
4.40	50	5.80	750	7.20	2,440	9.20	5,570
4.50	80	5.90	850	7.30	2,580	9.40	5,970
4.60	110	6.00	950	7.40	2,720	9.60	6,390
4.70	140	6.10	1,060	7.50	2,860	9.80	6,820
4.80	175	6.20	1,170	7.60	3,000	10.00	7,280
4.90	215	6.30	1,280	7.70	3,140	11.00	10,200
5.00	255	6.40	1,400	7.80	3,280	12.00	14,300
5.10	300	6.50	1,520	7.90	3,420	13.00	19,300
5.20	350	6.60	1,640	8.00	3,570	14.00	25,000
5.30	400	6.70	1,770	8.20	3,880	15.00	31,200
5.40	450	6.80	1,900	8.40	4,200	16.00	37,800
5.50	510	6.90	2,030	8.60	4,520	17.00	44,700

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during February, 1907, to January, 1908, and is fairly well defined between gage heights 4.2 feet and 7 feet.

JANUARY 1 TO FEBRUARY 9, 1908.

[The indirect method for shifting channels used.]

FEBRUARY 10 TO DECEMBER 31, 1908.

3.90	3	4.90	245	5.90	990	6.90	2,360
4.00	10	5.00	285	6.00	1,110	7.00	2,510
4.10	20	5.10	335	6.10	1,240	7.10	2,660
4.20	35	5.20	385	6.20	1,370	7.20	2,810
4.30	55	5.30	440	6.30	1,510	7.30	2,960
4.40	78	5.40	500	6.40	1,650	7.40	3,120
4.50	105	5.50	575	6.50	1,790	7.50	3,280
4.60	135	5.60	660	6.60	1,930		
4.70	170	5.70	760	6.70	2,070		
4.80	205	5.80	870	6.80	2,210		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made during 1908 and the form of the previous curve at low stages, and is well defined between gage heights 5.5 feet and 7.5 feet.

Monthly discharge of Stony Creek near Fruto, Cal., for 1907 and 1908.

[Drainage area, 601[a] square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	6,100	380	2,020	3.36	3.87	124,000	C.
February	16,300	950	3,310	5.51	5.74	184,000	C.
March	26,500	660	4,430	7.37	8.50	272,000	C.
April	2,650	580	1,640	2.73	3.05	97,600	B.
May	580	350	450	.749	.86	27,700	B.
June	350	110	236	.393	.44	14,000	B.
July	110	30	47.1	.078	.09	2,900	B.
August	15	15	15	.025	.03	922	C.
September	30	15	19	.032	.04	1,130	C.
October	30	30	30	.050	.06	1,840	C.
November	50	30	44	.073	.08	2,620	C.
December	3,070	50	597	.993	1.14	36,700	B.
The year	26,500	15	1,070	1.78	23.90	765,000	

[a] Revised since the 1906 report.

Monthly discharge of Stony Creek near Fruto, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	3,600	310	1,140	1.90	2.19	70,100	B.
February	7,800	500	1,680	2.80	3.02	96,600	B.
March	2,210	575	993	1.65	1.90	61,100	B.
April	500	400	525	.874	.98	31,200	B.
May	385	285	364	.606	.70	22,400	B.
June	285	105	186	.309	.34	11,100	B.
July	78	35	47.6	.079	.09	2,930	C.
August	20	10	14.8	.025	.03	910	D.
September	20	3	6.83	.011	.01	406	D.
October	55	20	34	.057	.07	2,090	C.
November	187	55	88.2	.147	.16	5,250	C.
December	500	105	192	.379	.44	11,800	B.
The year	7,800	3	439	.736	9.93	316,000	

LITTLE STONY CREEK NEAR LODOGA, CAL.

This station was established by the United States Reclamation Service in March, 1907, for the purpose of determining the quantity of water available for storage in the East Park reservoir, is located at the East Park dam site (see Pl. IV, *A*), 3½ miles northwest of Lodoga, in sec. 3, T. 17 N., R. 6 W., Mount Diablo base and meridian, and is about 4 miles above the mouth of the creek. Records are furnished by the Reclamation Service.

Indian Creek enters Little Stony Creek from the east a short distance above the station. The channel is composed of clean rock, gravel, and sand, which shifts during high water. The current is swift at moderate and high stages.

The gage datum was changed in the fall of 1907. The records are only fair owing to changes in channel.

Discharge measurements of Little Stony Creek near Lodoga, Cal., in 1907 and 1908.

[By United States Reclamation Service engineers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-feet.*	1907.	*Feet.*	*Sec.-feet.*	1907.	*Feet.*	*Sec.-feet.*
February 20	3.50	96	March 17	11.15	3,210	Do	5.6	698
March 5	4.25	314	Do	12.40	4,030	March 23	7.8	1,580
March 6	3.87	198	Do	12.50	3,930	March 24	6.65	1,050
March 7	3.80	156	March 18	13.10	3,940	June 11	3.20	28
March 8	3.70	149	Do	12.85	3,370	July 28	2.9	2.4
March 9	4.00	189	Do	12.00	2,860	November 27	2.8	1.0
Do	4.70	387	Do	12.30	2,700	December 8	3.1	15
Do	5.93	609	Do	12.40	3,290	December 27	3.46	76
Do	5.63	471	March 19	8.95	2,280			
March 10	4.40	275	Do	8.65	2,300	1908.		
Do	4.30	264	Do	8.5	2,080	February 1	3.94	171
March 11	4.15	222	Do	8.45	2,250	February 7	4.87	605
March 12	4.00	186	Do	8.6	2,330	Do	4.92	648
March 13	3.85	162	March 20	7.55	1,630	February 9 [a]	5.87	1,260
March 14	3.75	145	Do	6.95	1,500	Do.[a]	6.50	1,810
March 15	3.70	132	Do	7.35	1,570	February 17	3.51	143
March 16	3.80	160	March 21	6.45	1,010	March 21	3.40	100
March 17	7.80	1,380	Do	6.15	906	June 2	2.65	8.4
Do	8.25	1,420	March 22	5.6	707			

[a] Measured by floats.

Daily gage height, in feet, of Little Stony Creek near Lodoga, Cal., for 1908

[Ora Gordon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1	4.0	4.3	3.2	3.0	2.7	2.5	2.4	2.3	.....	.....	2.3
2	3.5	4.3	3.9	3.2	3.0	2.7	2.5	2.4	2.3	.....	.....	2.3
3	3.4	4.2	3.8	3.2	2.9	2.7	2.5	2.4	2.3	.....	.....	2.3
4	3.4	4.2	3.7	3.1	2.9	2.7	2.5	2.4	2.3	.....	.....	2.3
5	3.4	5.6	3.6	3.1	2.9	2.7	2.4	2.4	2.3	.....	.....	3.0
6	3.3	5.7	3.5	3.1	2.9	2.7	2.4	2.4	2.3	.....	.....	2.8
7	3.3	5.0	3.5	3.1	2.9	2.7	2.4	2.4	2.3	.....	.....	2.7
8	3.3	4.6	3.4	3.0	2.9	2.7	2.4	2.4	2.3	.....	.....	2.7
9	3.5	6.3	3.4	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	3.2
10	3.3	4.8	3.4	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	3.2
11	3.3	4.3	3.4	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	3.0
12	3.3	4.0	3.4	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.9
13	3.3	3.9	3.4	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.8
14	3.7	3.8	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.8
15	3.5	3.7	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.8
16	3.5	3.7	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.7
17	3.5	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.7
18	3.6	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.7
19	3.6	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	.....	.....	2.7
20	4.3	3.5	3.4	3.0	2.9	2.6	2.4	2.4	2.2	.....	.....	2.7
21	4.1	3.4	3.4	3.0	2.9	2.6	2.4	2.4	2.1	.....	.....	2.7
22	4.1	3.4	3.4	3.0	2.9	2.6	2.4	2.4	2.1	.....	2.0	2.7
23	3.9	3.4	3.4	3.0	2.9	2.6	2.4	2.4	.....	.....	2.1	2.7
24	4.5	3.4	3.4	3.0	2.9	2.5	2.4	2.4	.....	.....	2.1	2.7
25	4.1	3.4	3.4	3.0	2.9	2.5	2.4	2.4	.....	.....	2.1	2.7
26	3.9	3.4	3.3	3.0	2.9	2.5	2.4	2.4	.....	.....	2.4	2.7
27	3.8	3.5	3.3	3.0	2.9	2.5	2.4	2.4	.....	.....	2.4	2.7
28	3.7	3.5	3.2	3.0	2.9	2.5	2.4	2.4	.....	.....	2.4	2.7
29	3.6	3.5	3.2	3.0	2.9	2.5	2.4	2.4	.....	.....	2.3	2.7
30	3.6	.....	3.2	3.0	2.9	2.5	2.4	2.4	.....	.....	2.3	2.7
31	3.6	.....	3.2	.....	2.8	.....	2.4	2.4	.....	.....	.....	2.7

NOTE.—The creek was dry and water standing in pools September 23 to November 21.

Rating table for Little Stony Creek near Lodoga, Cal., January 1 to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	0.0	3.30	80	4.50	417	5.70	1,143
2.20	.5	3.40	97	4.60	465	5.80	1,219
2.30	1.5	3.50	116	4.70	515	5.90	1,298
2.40	3	3.60	136	4.80	568	6.00	1,380
2.50	5	3.70	157	4.90	623	6.10	1,462
2.60	8	3.80	180	5.00	680	6.20	1,546
2.70	13	3.90	204	5.10	740	6.30	1,630
2.80	20	4.00	230	5.20	802	6.40	1,714
2.90	28	4.10	259	5.30	866	6.50	1,800
3.00	38	4.20	292	5.40	932		
3.10	50	4.30	330	5.50	1,000		
3.20	64	4.40	372	5.60	1,070		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1908 and is fairly well defined between gage heights 2.65 feet and 6.5 feet. Above gage height 6.5 feet the rating curve is a tangent, the difference being 88 per tenth.

Monthly discharge of Little Stony Creek near Lodoga, Cal., for 1908.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	417	80	155	1.52	1.75	9,530	C.
February	1,630	97	322	3.16	3.41	18,500	C.
March	330	64	113	1.11	1.28	6,950	C.
April	64	38	42.2	.414	.46	2,510	C.
May	38	20	28.4	.278	.32	1,750	C.
June	13	5	8.6	.084	.09	512	C.
July	5	3	3.3	.032	.04	203	D.
August	3	3	3.0	.029	.03	184	D.
September	1.5	0	1.0	.0098	.01	60	D.
October	0	0	0	.00	.00	0	
November	3	0	.4	.0039	.004	24	D.
December	64	1.5	17.8	.175	.20	1,090	C.
The year	1,630	0	57.9	.568	7.59	41,300	

CACHE CREEK DRAINAGE BASIN.

DESCRIPTION.

The Cache Creek drainage basin lies on the eastern slope of the Coast Range in Lake, Colusa, and Yolo counties, immediately south and west of the south end of the Stony Creek basin and north of the Puta Creek basin. The upper part of the basin, consisting of about 824 square miles, lies in the central part of Lake County, south of the divide separating the Eel River and Cache Creek basins. It is roughly rectangular in shape, and contains Clear Lake in its center. From Lake County the basin extends southeastward to the Sacramento Valley as a strip about 50 miles long and 10 miles wide. The total area of the basin is 1,290 square miles.

Cache Creek is the only known outlet of Clear Lake. The lake is very irregular in shape and has an area of 65 square miles and an elevation of 1,325 feet at mean level. Its length is 20 miles and its greatest width 7 miles. The upper part, or main lake, has a maximum depth of 35 feet, but the lower neck has a few small areas as much as 50 feet in depth. The drainage area tributary to the lake is about 417 square miles, chiefly toward the south and west. The principal creeks flowing into the lake are Scotts, Middle, and Clover from the west, and Doba, Kelsey, and Cole from the south. They are torrential during the rainy season, but are practically dry in the summer.

From the lake Cache Creek flows southeastward to Yolo basin and ultimately into Sacramento River through sloughs. Its total length is about 80 miles.

The largest and most important tributary of Cache Creek is the North Fork, which drains 250 square miles in the eastern part of

Lake County. The only other tributary of much importance is Bear Creek, which drains the western part of Colusa County. These creeks are very small in the summer, but rarely become dry. All the tributaries are torrential.

The upper part of the Cache Creek drainage basin in Lake County is mountainous and very rugged. Some of the peaks reach an altitude of 6,000 feet above sea level, and their slopes, as well as those of the lower ranges, are very steep. About 5 miles below the outlet the creek enters Cache Creek Canyon, in which it flows for 25 miles on an average grade of 35 feet to the mile. In some places the canyon walls are vertical cliffs 300 feet high. Below the canyon the creek enters Capay Valley, from 1 to 3 miles wide and 20 miles long, through which it winds for a distance of nearly 30 miles before entering the Sacramento Valley.

The forest covering in the Cache Creek drainage basin is very good. On the northern slope of the ranges around Clear Lake are fine belts of fir, oak, and pine. Elsewhere on the high ranges the vegetation consists of a dense growth of greasewood and chaparral. A strip along the northern edge of the basin is included in a national forest.

The mean annual precipitation ranges from 17 inches in the Sacramento Valley to 40 inches or more on the mountainous summits in Lake County, where much of it occurs as snowfall in the winter season.

Cache Creek furnishes exceptional opportunities for irrigation development in Yolo County. At the present time many ditches take water from the creek for irrigating land in the vicinity of Woodland and Yolo.

Good storage sites are also available in this basin. Clear Lake is a natural storage reservoir which is very powerful in regulating Cache Creek.[a]

The opportunities for water-power development on Cache Creek are excellent.

The upper part of this basin contains springs, a number of which, especially in the North Fork basin, have medicinal properties that attract hundreds of visitors during the summer. Bartlett Springs are probably the best known.

The longest run-off record in Cache Creek basin dates back to 1900. The wettest year since that date was 1904, and the driest 1908. The flow for the wettest year was more than three times as great as that for the driest. The following gaging stations have been maintained in this basin:

Cache Creek at Lower Lake (1901 to 1908).
Cache Creek near Yolo (1903 to 1908).

[a] For a detailed account of storage on Cache Creek see Water-Supply Paper 45.

CACHE CREEK AT LOWER LAKE, CAL.

This station, which was established January 1, 1901, to determine the outflow of Clear Lake, is located a short distance above the wagon bridge just below the outlet of Clear Lake and about 1 mile from Lower Lake.

No tributaries enter above the station except those which come into Clear Lake. Siegler Creek enters about 300 feet below the station, but it is very small except in flood flow of short periods. North Fork joins the main creek about 14 miles below the lake.

The flow at the station is regulated by Clear Lake, which diminishes the intensity of floods and prolongs the summer flow. The gage datum has remained unchanged during the life of the station.

The records are excellent. The section is practically constant, and the station has been well rated.

The following measurement was made September 20, 1907:

Width, 55 feet; area, 118 square feet; gage height, 345 feet; discharge, 158 second-feet.

Daily gage height, in feet, of Cache Creek at Lower Lake, Cal., for 1907 and 1908.

[J. R. Anderson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.9	5.25	6.2	11.5	9.0	6.4	5.35	4.45	3.7	3.6	3.2	3.05
2	3.85	5.55	6.2	11.4	8.9	6.35	5.35	4.4	3.65	3.3	3.15	3.0
3	3.9	5.9	6.15	11.3	8.75	6.3	5.25	4.4	3.65	3.3	3.15	3.0
4	4.2	6.0	6.15	11.2	8.6	6.25	5.25	4.35	3.65	3.25	3.15	3.1
5	4.2	6.1	6.35	11.15	8.4	6.2	5.2	4.35	3.65	3.25	3.15	3.0
6	4.2	6.2	6.25	11.1	8.4	6.15	5.2	4.3	3.65	3.25	3.15	3.2
7	4.2	6.2	6.25	11.0	8.35	6.2	5.25	4.3	3.65	3.25	3.15	3.2
8	4.25	6.25	6.3	10.95	8.3	6.2	5.1	4.25	3.6	3.2	3.1	3.1
9	4.5	6.3	6.5	10.9	8.25	6.05	5.05	4.25	3.6	3.2	3.15	3.1
10	4.5	6.25	6.5	10.8	8.25	6.0	5.05	4.2	3.6	3.2	3.15	3.25
11	4.45	6.25	6.7	10.7	8.5	6.0	5.0	4.15	3.6	3.2	3.1	3.2
12	4.6	6.25	6.55	10.6	8.3	5.95	4.95	4.1	3.6	3.25	3.1	3.2
13	4.45	6.2	6.6	10.5	8.2	5.9	4.95	4.1	3.55	3.2	3.2	3.2
14	4.6	6.2	6.6	10.4	8.0	5.85	4.9	4.1	3.55	3.2	3.1	3.25
15	4.5	6.2	6.6	10.3	7.9	5.8	4.9	4.05	3.55	3.2	3.1	3.3
16	4.5	6.2	6.65	10.2	7.8	5.8	4.85	4.05	3.5	3.2	3.15	3.3
17	4.6	6.2	7.9	10.15	7.75	5.75	4.85	4.05	3.5	3.2	3.0	3.3
18	4.7	6.2	8.9	10.3	7.5	5.75	4.8	4.0	3.5	3.2	3.1	3.3
19	4.7	6.2	9.7	10.2	7.4	5.7	4.8	4.0	3.45	3.2	3.15	3.4
20	4.65	6.15	10.1	10.1	7.3	5.7	4.75	4.0	3.45	3.2	3.1	3.3
21	4.65	6.15	10.45	10.05	7.2	5.75	4.75	3.95	3.45	3.2	3.0	3.3
22	4.65	6.2	10.5	10.0	7.0	5.6	4.7	3.9	3.45	3.2	3.0	3.3
23	4.6	6.15	11.25	9.9	6.9	5.6	4.7	3.9	3.4	3.2	3.0	3.35
24	4.7	6.1	11.55	9.8	6.85	5.55	4.65	3.9	3.4	3.15	3.0	3.3
25	4.75	6.3	11.75	9.6	6.7	5.5	4.65	3.85	3.4	3.1	3.0	3.35
26	4.8	6.2	11.75	9.4	6.8	5.5	4.6	3.85	3.4	3.15	2.95	3.5
27	4.9	6.2	11.75	9.4	6.6	5.45	4.55	3.8	3.45	3.2	2.95	3.5
28	4.9	6.2	11.7	9.3	6.5	5.45	4.55	3.8	3.5	3.2	2.95	3.5
29	4.9	.....	11.65	9.2	6.5	5.4	4.5	3.8	3.35	3.2	2.95	3.4
30	4.95	.....	11.6	9.1	6.5	5.4	4.5	3.75	3.35	3.2	3.0	3.6
31	5.15	.....	11.55	.....	6.4	.....	4.45	3.75	.....	3.2	.....	3.7
1908.												
1	3.7	4.6	5.75	5.55	4.7	4.15	3.5	3.05	2.6	2.4	1.95	2.05
2	3.7	5.55	5.85	5.45	4.9	4.1	3.45	3.05	2.6	2.3	2.0	2.05
3	3.8	5.0	5.8	5.4	4.75	4.05	3.45	3.05	2.6	2.2	1.95	2.05
4	3.8	5.0	5.8	5.45	4.7	4.0	3.45	3.05	2.6	2.2	2.0	2.1
5	3.8	5.0	5.8	5.45	4.7	4.0	3.45	3.0	2.6	2.2	2.0	2.2

Daily gage height, in feet, of Cache Creek at Lower Lake, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	3.85	5.0	5.8	5.4	4.7	3.95	3.4	3.0	2.6	2.2	2.0	2.2
7	3.85	5.2	5.8	5.3	4.65	3.95	3.4	3.0	2.55	2.15	2.0	2.15
8	3.85	5.1	5.8	5.3	4.6	3.95	3.4	3.0	2.55	2.15	1.95	2.1
9	3.9	5.65	5.75	5.25	4.6	3.95	3.35	3.0	2.5	2.2	1.95	2.25
10	3.9	5.5	5.75	5.25	4.55	3.9	3.35	3.0	2.5	2.2	2.0	2.25
11	3.9	5.5	5.75	5.25	4.55	3.85	3.35	3.0	2.4	2.15	2.0	2.3
12	3.9	5.55	5.75	5.25	4.5	3.85	3.35	3.0	2.45	2.15	1.95	2.25
13	3.9	5.6	5.8	5.25	4.5	3.8	3.35	2.95	2.5	2.2	1.95	2.35
14	4.05	5.6	5.8	5.25	4.5	3.8	3.3	2.95	2.5	2.15	1.95	2.3
15	4.0	5.6	5.8	5.2	4.4	3.8	3.3	2.9	2.5	2.2	1.95	2.4
16	4.0	5.6	5.75	5.25	4.4	3.8	3.3	2.9	2.5	2.1	1.9	2.3
17	4.0	5.6	5.75	5.2	4.35	3.8	3.3	2.9	2.45	2.1	1.9	2.25
18	4.0	5.6	5.7	5.2	4.35	3.75	3.3	2.9	2.4	2.1	1.9	2.3
19	4.05	5.5	5.7	5.1	4.4	3.75	3.25	2.9	2.4	2.1	2.0	2.3
20	4.2	5.5	5.7	5.05	4.35	3.7	3.25	2.85	2.4	2.1	[a] 2.5	2.25
21	4.2	5.5	5.65	5.0	4.3	3.7	3.25	2.85	2.35	2.05	1.9	2.3
22	4.25	5.5	5.65	5.0	4.3	3.65	3.25	2.85	2.35	2.0	1.95	2.3
23	4.25	5.45	5.65	4.95	4.3	3.65	3.2	2.8	2.3	2.0	2.3	2.3
24	4.3	5.45	5.65	4.95	4.3	3.6	3.2	2.8	2.35	2.0	2.2	2.3
25	4.4	5.45	5.6	4.9	4.25	3.6	3.2	2.75	2.35	2.0	2.1	2.3
26	4.4	5.5	5.65	4.9	4.25	3.55	3.2	2.75	2.3	2.0	2.1	2.3
27	4.45	5.5	5.7	4.85	4.2	3.5	3.15	2.7	2.3	1.95	2.1	2.3
28	4.45	5.5	5.6	4.85	4.2	3.5	3.15	2.7	2.3	1.95	2.1	2.25
29	4.45	5.6	5.55	4.85	4.2	3.5	3.15	2.65	2.3	1.9	2.05	2.3
30	4.5	.....	5.6	4.8	4.2	3.5	3.1	2.65	2.25	1.95	2.05	2.25
31	4.5	.....	5.6	.....	4.2	.....	3.1	2.6	.....	1.95	.....	2.2

[a] High gage height due to heavy wind on lake.

Rating table for Cache Creek at Lower Lake, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	5	3.20	128	4.50	395	6.60	999
2.00	6	3.30	145	4.60	419	6.80	1,063
2.10	8	3.40	164	4.70	444	7.00	1,127
2.20	12	3.50	183	4.80	469	7.20	1,191
2.30	18	3.60	202	4.90	494	7.40	1,257
2.40	27	3.70	222	5.00	520	7.60	1,324
2.50	37	3.80	242	5.20	575	7.80	1,392
2.60	48	3.90	262	5.40	631	8.00	1,460
2.70	59	4.00	282	5.60	690	9.00	1,840
2.80	71	4.10	303	5.80	750	10.00	2,260
2.90	84	4.20	325	6.00	810	11.00	2,760
3.00	97	4.30	348	6.20	872	12.00	3,300
3.10	112	4.40	371	6.40	935		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1905 to 1909, and the general form of previous curves, and is fairly well defined.

Monthly discharge of Cache Creek at Lower Lake, Cal., for 1907 and 1908.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	561	252	404	0.808	0.93	24,800	A.
February	903	589	850	1.70	1.77	47,200	A.
March	3,160	856	1,790	3.58	4.13	110,000	A.
April	3,020	1,880	2,450	4.90	5.47	146,000	A.
May	1,840	935	1,360	2.72	3.14	83,600	A.
June	935	631	766	1.53	1.71	45,600	A.
July	617	383	467	.934	1.08	28,700	A.
August	383	232	298	.596	.69	18,300	A.
September	222	154	188	.376	.42	11,200	B.
October	202	112	132	.264	.30	8,120	B.
November	128	90	109	.218	.24	6,490	B.
December	222	97	142	.284	.33	8,730	B.
The year	3,160	90	746	1.49	20.21	539,000	
1908.							
January	395	222	300	.600	.69	18,400	B.
February	705	419	634	1.27	1.37	36,500	A.
March	765	675	726	1.45	1.67	44,600	A.
April	675	469	566	1.13	1.26	33,700	A.
May	494	325	383	.766	.88	23,600	A.
June	314	183	240	.480	.54	14,300	B.
July	183	112	145	.290	.33	8,920	B.
August	104	48	83.0	.166	.19	5,100	C.
September	48	15	32.0	.064	.07	1,900	C.
October	27	5.0	9.52	.019	.02	585	C.
November	[a] 37	5.0	7.68	.015	.02	457	C.
December	27	7.0	15.2	.030	.03	935	C.
The year	765	5.0	262	.523	7.07	189,000	

[a] Maximum caused by high wind on lake.

CACHE CREEK NEAR YOLO, CAL.

This station was established January 1, 1903, at the old wagon bridge on the road from Woodland to Yolo, about 1,000 feet above the railroad bridge, for the purpose of obtaining general statistical and comparative data regarding the flow of Cache Creek. The data are useful in connection with power and irrigation development and in studies of flood prevention in Sacramento Valley. In the fall of 1904 a new bridge was constructed, and the station was reestablished December 4.

No important tributaries enter within 12 or 15 miles of the station.

Many diversions are made from Cache Creek above the station, water being used for irrigation around Yolo and Woodland. The irrigating ditches usually take all the late summer flow. All available water in this basin has been filed upon, and all lands embraced within storage reservoirs are held in private ownership.

The gage datum has remained unchanged during the life of the station.

The records are good, considered as a whole. The bed of the stream is composed of earth, gravel, and sand, and is subject to some change. The banks are steep and well wooded, and their height has been

increased by levees, which are overtopped at extremely high water. The current is swift at moderate and high stages. The creek is dry at the station almost every summer or fall.

Discharge measurements of Cache Creek near Yolo, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12	R. S. Hawley	96	379	5.10	1,520
February 25	do	95	347	4.48	1,270
March 9	do	96	355	4.60	1,390
March 15	do	97	406	5.15	1,850
March 21	do	115	1,200	12.25	6,220
March 30	W. G. Steward	109	847	9.70	5,630
April 1	do	101	806	9.45	5,120
April 27	do	99	487	6.00	2,360
May 6	do	97	436	5.20	1,880
May 17	do	96	383	4.60	1,270
June 21	W. F. Martin	90	261	3.22	695
August 19	do	86	131	1.90	147
September 13	W. A. Lamb	44	59	1.39	55
October 4	do	43	54	1.32	38
October 14	do	36	46	1.19	18
October 29	do	90	119	1.50	91
1908.					
January 3	W. A. Lamb	90	230	3.00	626
January 29	do	91	251	3.35	828
February 6	do	99	564	6.32	2.910
February 11	do	100	512	5.85	2,400
February 17	do	95	323	4.33	1,280
February 25	do	90	275	3.90	975
March 4	do	97	387	4.75	1,640
March 10	do	95	311	4.15	1,210
April 5	do	90	249	3.30	791
April 23	do	90	210	2.85	580
June 23	W. B. Clapp	23	26	1.10	35

NOTE.—Creek dry from August 2 to December 31, 1908. The measurement on March 21, 1907, was made just after the big flood and was possibly affected by back-water from the Yolo basin.

Daily gage height, in feet, of Cache Creek near Yolo, Cal., for 1907 and 1908.

[Cornelia Bigelow, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	10.2	4.8	9.4	5.7	3.85	2.95	2.35	1.4	1.2	1.5	1.4
2	2.75	12.6	4.8	9.3	5.5	3.85	2.9	2.3	1.35	1.2	1.55	1.4
3	2.7	10.85	4.65	9.3	5.5	3.8	2.9	2.3	1.35	1.3	1.6	1.4
4	3.2	8.25	4.6	9.2	5.55	3.8	2.9	2.3	1.35	1.3	1.6	1.35
5	7.3	6.5	4.55	9.1	5.4	3.8	2.85	2.25	1.4	1.3	1.55	1.35
6	4.35	6.7	5.3	9.0	5.3	3.75	2.85	2.2	1.5	1.25	1.55	1.35
7	3.95	6.25	4.9	8.75	5.3	3.75	2.85	2.2	1.5	1.25	1.5	1.3
8	4.4	5.8	4.7	8.6	5.2	3.7	2.8	2.15	1.45	1.25	1.5	1.35
9	8.1	5.6	4.8	8.4	5.1	3.7	2.8	2.1	1.45	1.2	1.5	1.4
10	15.65	5.5	6.05	8.15	5.0	3.6	2.8	2.1	1.4	1.2	1.5	1.5
11	6.65	5.3	5.65	8.0	4.9	3.6	2.75	2.05	1.4	1.2	1.5	1.8
12	5.4	5.1	5.5	7.9	4.9	3.55	2.75	2.05	1.35	1.2	1.5	2.1
13	4.75	5.0	5.35	7.7	4.85	3.5	2.75	2.05	1.35	1.2	1.5	2.0
14	4.45	4.9	5.15	7.5	4.8	3.5	2.7	2.0	1.35	1.2	1.5	1.9
15	4.25	4.8	4.9	7.4	4.7	3.45	2.7	2.0	1.35	1.2	1.5	2.0
16	4.0	4.7	5.0	7.2	4.6	3.45	2.65	1.95	1.3	1.2	1.5	1.95
17	4.55	4.65	6.8	7.1	4.5	3.4	2.65	1.95	1.3	1.2	1.5	1.9
18	4.3	4.9	19.45	6.95	4.4	3.35	2.65	1.9	1.3	1.15	1.5	1.85
19	3.95	4.9	25.9	6.8	4.35	3.35	2.6	1.9	1.25	1.15	1.5	1.8
20	3.85	4.7	18.2	6.7	4.3	3.3	2.6	1.9	1.25	1.15	1.5	1.8
21	3.85	4.65	12.65	6.6	4.2	3.25	2.6	1.85	1.2	1.15	1.45	1.9
22	3.8	4.6	12.0	6.55	4.1	3.2	2.55	1.85	1.2	1.5	1.4	2.0
23	3.8	4.55	20.85	6.4	4.1	3.2	2.55	1.8	1.2	1.5	1.4	1.9
24	3.9	4.5	19.3	6.3	4.1	3.15	2.5	1.8	1.15	1.5	1.4	1.85
25	4.05	4.7	16.15	6.2	4.0	3.1	2.5	1.75	1.15	1.55	1.4	1.85

Daily gage height, in feet, of Cache Creek near Yolo, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	4.3	5.0	12.55	6.1	4.0	3.1	2.5	1.7	1.15	1.6	1.4	1.85
27	4.4	4.8	11.0	6.0	3.95	3.0	2.45	1.65	1.1	1.6	1.45	2.1
28	7.1	4.65	10.35	6.0	3.95	3.0	2.45	1.65	1.1	1.55	1.45	2.6
29	6.3	.....	10.0	5.9	3.9	2.95	2.4	1.5	1.1	1.5	1.45	2.4
30	5.05	.....	9.65	5.8	3.9	2.95	2.4	1.4	1.1	1.5	1.4	2.4
31	5.15	.....	9.5	.....	3.9	.....	2.35	1.4	.....	1.5	.....	4.5
1908.												
1	4.45	3.65	7.4	3.4	2.55	1.75	.85	.5	.....	.....	.....	.....
2	3.65	6.5	6.0	3.4	2.5	1.7	.85	.45	.....	.....	.....	.....
3	3.2	10.2	5.05	3.35	2.55	1.7	.85	.....	.....	.....	.....	.....
4	3.0	6.7	4.75	3.35	2.5	1.6	.85	.....	.....	.....	.....	.....
5	3.05	5.5	4.5	3.3	2.45	1.5	.85	.....	.....	.....	.....	.....
6	3.7	6.2	4.3	3.3	2.5	1.4	.8	.....	.....	.....	.....	.....
7	2.5	5.5	4.25	3.3	2.4	1.4	.8	.....	.....	.....	.....	.....
8	2.45	5.25	4.2	3.25	2.35	1.3	.75	.....	.....	.....	.....	.....
9	2.45	8.75	4.2	3.2	2.3	1.3	.7	.....	.....	.....	.....	.....
10	2.7	7.7	4.15	3.2	2.3	1.5	.7	.....	.....	.....	.....	.....
11	2.6	5.9	4.15	3.15	2.25	1.4	.65	.....	.....	.....	.....	.....
12	2.5	5.3	4.15	3.15	2.2	1.35	.65	.....	.....	.....	.....	.....
13	2.45	4.95	4.15	3.1	2.2	1.3	.65	.....	.....	.....	.....	.....
14	2.8	4.7	4.2	3.1	2.2	1.3	.65	.....	.....	.....	.....	.....
15	3.3	4.6	4.2	3.05	2.15	1.25	.6	.....	.....	.....	.....	.....
16	3.05	4.45	4.15	3.05	2.15	1.4	.6	.....	.....	.....	.....	.....
17	2.85	4.3	4.15	3.0	2.15	1.35	.6	.....	.....	.....	.....	.....
18	2.7	4.25	4.1	3.0	2.15	1.3	.6	.....	.....	.....	.....	.....
19	3.05	4.2	4.0	2.95	2.1	1.25	.6	.....	.....	.....	.....	.....
20	3.25	4.1	3.9	2.95	2.2	1.25	.6	.....	.....	.....	.....	.....
21	4.65	4.0	3.85	2.9	2.2	1.2	.65	.....	.....	.....	.....	.....
22	4.05	3.95	3.8	2.9	2.1	1.15	.65	.....	.....	.....	.....	.....
23	3.8	3.9	3.8	2.9	2.0	1.05	.65	.....	.....	.....	.....	.....
24	3.85	3.85	3.75	2.85	1.95	0.9	.55	.....	.....	.....	.....	.....
25	4.65	3.9	3.65	2.85	1.9	0.9	.5	.....	.....	.....	.....	.....
26	4.0	3.9	3.6	2.85	1.9	0.9	.5	.....	.....	.....	.....	.....
27	3.75	3.85	3.55	2.8	1.9	.85	.55	.....	.....	.....	.....	.....
28	3.6	3.85	3.5	2.7	1.9	.85	.55	.....	.....	.....	.....	.....
29	3.45	4.15	3.5	2.65	1.85	.85	.5	.....	.....	.....	.....	.....
30	3.4	.....	3.45	2.6	1.85	.85	.5	.....	.....	.....	.....	.....
31	3.2	.....	3.45	.....	1.75	.....	.5	.....	.....	.....	.....	.....

NOTE.—The creek was dry, the water standing in pools, from August 2 to December 31, 1908. Gage heights from about March 19 to March 29, 1907, are probably affected by back water from the Yolo basin, which had been flooded by water from Sacramento River.

Rating tables for Cache Creek near Yolo, Cal.

1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	10	2.70	430	4.60	1,380	11.00	6,540
1.20	20	2.80	470	4.80	1,500	12.00	7,390
1.30	35	2.90	510	5.00	1,640	13.00	8,240
1.40	50	3.00	550	5.20	1,780	14.00	9,090
1.50	70	3.10	590	5.40	1,920	15.00	9,940
1.60	95	3.20	635	5.60	2,060	16.00	10,790
1.70	120	3.30	680	5.80	2,210	17.00	11,640
1.80	145	3.40	725	6.00	2,370	18.00	12,490
1.90	170	3.50	775	6.20	2,530	19.00	13,340
2.00	200	3.60	825	5.40	2,690	20.00	14,190
2.10	230	3.70	875	5.60	2,850	21.00	15,040
2.20	260	3.80	925	6.80	3,010	22.00	15,890
2.30	290	3.90	980	7.00	3,170	23.00	16,740
2.40	325	4.00	1,035	8.00	3,990	24.00	17,590
2.50	360	4.20	1,145	9.00	4,840	25.00	18,440
2.60	395	4.40	1,260	10.00	5,690	26.00	19,290

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on sixteen discharge measurements made during 1907, and is well defined between gage heights 1.1 feet and 10.0 feet. Above gage height 8 feet the rating curve is a tangent, the difference being 85 per tenth.

Rating tables for Cache Creek near Yolo, Cal.—Continued

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.45	0	2.00	246	3.60	910	5.10	1,870
.50	1	2.10	280	3.70	960	5.20	1,945
.60	3	2.20	315	3.80	1,010	5.30	2,020
.70	5	2.30	352	3.90	1,062	5.40	2,100
.80	8	2.40	391	4.00	1,116	5.50	2,180
.90	13	2.50	431	4.10	1,176	5.60	2,260
1.00	22	2.60	471	4.20	1,238	5.70	2,340
1.10	35	2.70	513	4.30	1,300	5.80	2,420
1.20	50	2.80	555	4.40	1,365	5.90	2,500
1.30	66	2.90	597	4.50	1,435	6.00	2,580
1.40	84	3.00	639	4.60	1,505	7.00	3,380
1.50	104	3.10	681	4.70	1,575	8.00	4,200
1.60	127	3.20	725	4.80	1,645	9.00	5,040
1.70	153	3.30	770	4.90	1,720	10.00	5,900
1.80	182	3.40	815	5.00	1,795	11.00	6,780
1.90	213	3.50	862				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made during 1908 and is well defined.

Monthly discharge of Cache Creek near Yolo, Cal., for 1907 and 1908.

[Drainage area, 1,230 [a] square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	10,500	430	1,750	1.42	1.64	108,000	C.
February	7,900	1,320	2,360	1.92	2.00	131,000	C.
March [b]	19,200	1,350	5,380	4.37	5.04	331,000	C.
April	5,180	2,210	3,580	2.91	3.25	213,000	B.
May	2,130	980	1,430	1.16	1.34	87,900	B.
June	953	530	747	.607	.68	44,400	B.
July	530	310	421	.342	.39	25,900	B.
August	310	50	189	.154	.18	11,600	B.
September	70	10	36.0	.029	.03	2,140	B.
October	95	15	40.1	.033	.04	2,470	B.
November	95	50	67.5	.055	.06	4,020	B.
December	1,320	35	188	.153	.18	1,160	B.
The year	19,200	10	1,350	1.10	14.83	963,000	
1908.							
January	1,540	411	792	.644	.74	48,700	A.
February	6,080	935	1,950	1.59	1.71	112,000	A.
March	3,710	838	1,270	1.03	1.19	78,100	A.
April	815	471	662	.538	.60	39,400	A.
May	451	167	310	.252	.29	19,100	A.
June	167	10	66.6	.054	.06	3,960	B.
July	10	1	4.48	.0036	.004	275	D.
August	1	0	.03	.00	.00	2	D.
September	0	0	.0	.00	.00	0	
October	0	0	.0	.00	.00	0	
November	9	0	.0	.00	.00	0	
December	0	9	.0	.00	.00	0	
The year	6,080	0	421	.343	4.59	302,000	

[a] Area revised since 1906 report.
[b] Discharges for the high-water period in March may be too large, as measurement made March 21 gave results 18 per cent smaller than the rating curve.

NOTE.—The creek was dry from August 2 to December 31, 1908.

PUTA CREEK DRAINAGE BASIN.

DESCRIPTION.

The Puta Creek drainage basin lies on the eastern slope of the Coast Range south of the Cache Creek basin and north of Napa Valley. It includes the southern part of Lake County, the northern half of Napa County, and small parts of Yolo and Solano counties. The basin is rather long from northwest to southeast and comparatively narrow, being about 20 miles wide at the north and less than 10 miles at the east. It has a total area of about 810 square miles.

Puta Creek rises in the northwestern corner of the basin in the St. Helena Range, and flows southeastward into the Yolo basin near Davis, and thence into Sacramento River through Cache Slough. The total length of the creek is about 80 miles. It has numerous tributaries which have a heavy flood discharge in the winter but are practically dry during the summer. The chief tributaries are Soda Creek from the north and Pope Creek from the west.

The topography of the Puta Creek basin is very rugged. Much of the upper basin is rough and precipitous. The underlying rock is an impervious slate and serpentine with only a thin soil covering. There is very little tilled land in the basin except below the foothills. Altitudes range from about 100 feet in the valley to about 5,000 feet on the mountain summits.

The lower parts of the basin are comparatively barren of timber, though they have a considerable growth of grass and brush which extends down as far as the foothills. Moderate elevations have scattering timber, and the mountain summits have a fairly heavy timber growth.

The mean annual precipitation varies widely in the different parts of the basin. Along the foothills it averages about 28 inches, in the central part about 40 inches, and along the crest of the divide, where some of it occurs as snowfall in the winter, about 65 inches. Helen Mine, on the northern slope of Mount St. Helena, receives almost 100 inches annually.

Below the foothills is a large area of rich irrigable land, which could be supplied with water from Puta Creek. Some of this land is already irrigated and has been proved to be susceptible of the highest state of cultivation.

At least two good reservoir sites exist on the main stream—one near Winters and the other near Guenoc.

Only a small amount of power could be developed continuously in the Puta Creek basin without storage, because of the torrential nature of the streams. By utilizing the storage sites, however, many thousands of horsepower could be developed.

The longest run-off record on Puta Creek dates back to 1904. The wettest year since that date was 1907 and the driest 1908. The total flow in the driest year was 30 per cent of that in the wettest.

A gaging station was maintained on Puta Creek near Guenoc from February 12, 1904, to July 31, 1906. The only station now maintained in the basin is that on Puta Creek at Winters, 1905 to 1908.

PUTA CREEK AT WINTERS, CAL.

This station, which is located about 450 feet below the railroad bridge and 800 feet southeast of the railroad station at Winters, was established September 26, 1905, to determine the amount of water available for storage in the proposed reservoir near Winters. The data are very valuable for irrigation and power projects and for use in connection with any plan for flood prevention in the Sacramento Valley.

No important tributaries enter the creek within several miles of the station.

No water is diverted above the station, but a small quantity is diverted at the station for irrigation by pumping. Recent filings have been made on water in this basin and all reservoir sites are embraced within lands held by private ownership.

The gage datum has remained unchanged during the life of the station.

The records are good except at very low stages, when, owing to the width of channel and its tendency to shift somewhat, gage heights are not of much value.

Discharge measurements of Puta Creek at Winters, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 9	R. S. Hawley	200	2,450	17.35	13,000
Do	do	200	2,500	17.70	13,200
Do	do	200	2,570	18.10	13,900
January 10	do	192	1,640	13.35	7,370
Do	do	200	1,850	14.40	8,150
Do	do	190	1,540	12.85	7,110
Do	do	189	1,420	12.20	6,290
February 12	do	176	294	6.80	802
February 26	do	174	236	6.50	619
March 12	do	175	471	7.90	1,820
March 19	do	214	3,290	22.15	22,500
Do	do	212	3,070	21.20	18,000
March 20	do	197	2,150	16.90	10,000
Do	do	194	1,910	15.60	8,130
March 28	do	179	1,060	8.85	3,260
April 28	W. G. Steward	56	123	5.30	386
May 7	do	51	109	5.05	281
May 23	do	50	99	4.75	201
June 22	W. F. Martin	47	77	4.28	85
July 8	do	47	70	4.10	54
August 20	do	46	58	3.90	21
September 14	W. A. Lamb	14	35	3.90	17
October 5	do	14	35	3.90	17
October 30	do	18	39	3.96	23
1908.					
January 4	W. A. Lamb	106	183	5.52	554
January 28	do	110	181	5.75	602
February 5	do	176	585	7.40	1,900
February 13	do	175	316	6.45	1,010
February 24	do	93	142	5.50	352
February 28	do	60	132	5.40	311
March 4	do	171	402	6.85	1,450
March 9	do	133	204	5.88	578
March 13	do	75	139	5.60	421
April 4	do	60	101	5.05	162
April 23	do	60	92	4.88	116
June 23	W. B. Clapp	28	18	4.35	19
December 22	W. F. Martin	58	82	4.68	64

Daily gage height, in feet, of Puta Creek at Winters, Cal., for 1907 and 1908.

[F. S. Wyatt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.25	15.5	6.3	7.5	5.2	4.5	4.2	3.95	3.9	3.95	3.95	4.0
2	.....	16.3	.....	7.15	5.15	4.5	4.2	3.95	3.9	3.95	3.95	4.0
3	5.85	11.5	6.25	7.05	5.1	4.5	4.15	3.95	3.9	3.95	3.95	4.0
4	11.9	9.95	6.2	7.5	5.1	4.45	4.15	3.95	3.9	3.95	3.95	4.0
5	9.0	8.8	6.2	7.4	5.1	4.45	4.15	3.95	3.9	3.95	3.95	4.0
6	7.25	8.2	8.0	7.3	5.1	4.4	4.15	3.95	3.9	3.95	3.95	4.0
7	7.75	7.8	7.1	7.1	5.05	4.4	4.15	3.9	.....	3.9	3.95	4.1
8	7.55	7.5	6.7	6.95	5.05	4.4	4.1	3.95	3.9	3.9	3.95	4.1
9	14.3	7.2	6.6	6.75	5.0	4.4	4.1	3.9	3.9	3.9	3.95	4.2
10	14.95	7.1	8.15	6.55	5.0	4.4	4.1	3.9	3.9	3.9	3.95	4.2
11	9.7	6.9	7.85	6.4	4.95	4.4	4.1	3.9	3.85	3.9	3.95	4.3
12	8.35	6.8	8.05	6.25	4.95	4.4	4.05	3.9	3.9	3.9	3.95	5.0
13	8.0	6.7	7.4	6.15	4.9	4.45	4.05	3.9	3.9	3.9	3.95	4.6
14	7.4	6.6	7.1	6.05	4.9	4.5	4.0	3.9	3.9	3.9	3.95	4.55
15	7.65	6.5	6.95	6.05	4.85	4.5	4.0	3.9	3.9	3.9	3.95	4.55
16	7.1	6.45	7.5	5.95	4.85	4.4	4.0	3.9	3.9	3.9	3.95	4.65
17	8.05	6.4	15.3	5.85	4.8	4.5	4.0	3.9	3.9	3.9	3.95	4.45
18	7.9	6.35	21.6	5.7	4.8	4.45	4.0	3.9	3.9	3.9	3.95	4.55
19	7.2	6.3	23.65	5.6	4.75	4.45	4.0	3.9	3.9	3.9	4.0	4.45
20	7.1	6.25	16.15	5.7	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
21	.....	6.2	12.35	5.55	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
22	6.85	.....	11.9	5.5	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
23	6.8	6.8	26.6	5.5	4.75	4.4	4.0	3.9	3.9	3.9	4.0	4.4
24	6.75	6.5	15.6	5.45	4.75	4.4	4.0	3.9	3.9	3.9	4.0	4.35
25	6.8	6.4	14.75	5.4	4.7	4.35	4.0	3.9	3.9	3.9	3.95	4.3
26	7.0	6.7	11.4	5.4	4.7	4.3	3.95	3.9	3.9	3.95	4.0	4.6
27	7.2	6.4	10.0	5.35	4.65	4.25	3.95	3.9	3.9	3.95	4.0	4.6
28	14.35	6.3	9.15	5.3	4.65	4.25	3.95	3.9	3.9	3.95	4.0	5.1
29	9.95	.....	8.35	5.3	4.6	4.2	3.95	3.9	3.9	3.95	4.0	4.75
30	8.4	.....	7.85	5.25	4.55	4.2	3.95	3.85	3.95	3.95	4.0	4.65
31	7.8	.....	7.7	.....	4.55	.....	3.95	3.85	.....	3.95	.....	8.35
1908.												
1	7.4	5.4	8.75	5.1	4.75	4.55	4.2	4.05	4.0	3.9	4.0	4.2
2	6.45	14.25	8.4	5.1	4.75	4.55	4.15	4.05	4.0	3.9	4.0	4.3
3	5.65	10.6	7.75	5.1	4.75	4.5	4.2	4.05	4.0	3.9	4.05	4.3
4	5.4	7.2	7.2	5.05	4.75	4.5	4.2	4.05	4.0	3.9	4.0	4.3
5	5.6	7.25	6.55	5.05	4.75	4.5	4.2	4.05	3.9	3.9	4.0	4.5
6	5.3	7.0	6.3	5.05	.....	4.5	4.1	4.1	3.9	3.95	4.0	5.8
7	5.1	6.9	6.15	5.05	4.7	4.5	4.15	4.1	3.9	3.9	4.0	5.25
8	4.9	6.95	6.0	5.0	4.7	4.5	4.2	4.1	3.9	3.9	4.0	5.0
9	4.95	9.85	5.9	5.0	4.7	4.5	4.15	4.1	4.05	3.9	4.0	5.9
10	4.85	8.5	5.8	5.0	4.7	4.5	4.15	4.1	3.95	3.95	4.0	5.0
11	4.8	7.35	5.75	4.95	4.7	4.5	4.15	4.1	3.95	3.95	4.05	5.8
12	4.7	6.75	5.65	4.95	4.7	4.45	4.15	4.15	3.95	3.95	4.05	5.5
13	4.7	6.45	5.6	4.95	4.7	4.45	4.15	4.15	3.95	4.0	4.05	5.1
14	4.7	6.2	5.6	4.9	4.7	4.45	4.15	4.15	3.95	4.0	4.05	5.05
15	5.8	6.05	5.55	4.9	4.7	4.4	4.2	4.15	4.0	4.0	4.05	4.95
16	5.3	5.95	5.5	4.9	4.7	4.4	4.2	4.1	4.0	4.0	4.05	4.85
17	5.05	5.85	5.45	4.9	4.7	4.4	4.1	4.1	4.0	4.0	4.05	4.8
18	4.95	5.8	5.4	4.9	4.7	4.4	4.1	4.1	4.0	4.0	4.05	4.75
19	5.25	5.75	5.35	4.9	4.7	4.4	4.1	4.05	4.0	3.95	4.05	4.7
20	5.45	5.7	5.3	4.9	4.7	4.4	4.1	4.0	4.0	4.0	4.05	4.7
21	8.0	5.6	5.3	4.85	4.75	4.4	4.1	4.0	3.95	3.95	4.05	4.7
22	8.0	5.55	5.25	4.85	4.75	4.4	4.1	4.0	3.95	3.95	4.2	4.7
23	7.5	5.5	5.2	4.85	4.7	4.35	4.1	4.0	3.95	3.95	.....	4.65
24	8.75	5.5	5.2	4.85	4.65	4.35	4.05	4.0	3.95	4.0	4.2	4.65
25	7.5	5.45	5.2	4.85	4.65	4.3	4.05	4.0	3.9	4.0	4.2	4.65
26	6.45	5.45	5.15	4.85	4.6	4.4	4.05	4.0	3.9	4.0	4.35	4.7
27	6.15	5.4	5.15	4.85	4.6	4.25	4.1	4.0	3.9	4.0	4.3	4.7
28	5.8	5.35	5.2	4.8	4.55	4.25	4.1	4.05	3.9	4.0	4.2	4.7
29	5.6	5.6	5.15	4.8	4.55	4.2	4.1	4.05	3.9	4.0	4.2	4.7
30	5.5	.....	5.15	4.75	4.55	4.2	4.1	4.0	3.9	4.0	4.2	4.65
31	5.45	.....	5.1	.....	.....	.....	4.1	4.0	.....	4.0	.....	4.65

Rating tables for Puta Creek at Winters, Cal.

JANUARY 1 TO MARCH 19, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.80	340	7.40	1,350	9.00	2,660	13.00	6,880
5.90	370	7.50	1,430	9.20	2,840	14.00	8,120
6.00	400	7.60	1,510	9.40	3,020	15.00	9,420
6.10	440	7.70	1,590	9.60	3,200	16.00	10,820
6.20	490	7.80	1,670	9.80	3,400	17.00	12,300
6.30	540	7.90	1,750	10.00	3,600	18.00	13,800
6.40	600	8.00	1,830	10.20	3,800	19.00	15,400
6.50	660	8.10	1,910	10.40	4,000	20.00	17,100
6.60	730	8.20	1,990	10.60	4,200	21.00	19,000
6.70	800	8.30	2,070	10.80	4,400	22.00	21,000
6.80	870	8.40	2,150	11.00	4,600	23.00	23,200
6.90	950	8.50	2,230	11.20	4,800	24.00	25,400
7.00	1,030	8.60	2,310	11.40	5,020	25.00	27,700
7.10	1,110	8.70	2,390	11.60	5,240	26.00	30,000
7.20	1,190	8.80	2,480	11.80	5,460		
7.30	1,270	8.90	2,570	12.00	5,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907, and is well defined between gage heights 5.8 feet and 18 feet.

MARCH 20 TO 27, 1907.

[The indirect method for shifting channels used.]

MARCH 28 TO DECEMBER 31, 1907.

3.90	15	5.00	270	6.10	820	7.40	1,800
4.00	32	5.10	304	6.20	880	7.60	1,980
4.10	50	5.20	340	6.30	950	7.80	2,180
4.20	70	5.30	380	6.40	1,020	8.00	2,380
4.30	90	5.40	430	6.50	1,090	8.20	2,580
4.40	110	5.50	480	6.60	1,160	8.40	2,800
4.50	131	5.60	530	6.70	1,230	8.60	3,020
4.60	154	5.70	580	6.80	1,300	8.80	3,240
4.70	180	5.80	640	6.90	1,380	9.00	3,480
4.80	208	5.90	700	7.00	1,460	9.20	3,720
4.90	238	6.00	760	7.20	1,620		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on ten discharge measurements made during March to October, 1907, and is well defined.

JANUARY 1 TO FEBRUARY 1, 1908.

4.70	185	5.80	670	6.90	1,430	8.00	2,370
4.80	215	5.90	730	7.00	1,515	8.10	2,460
4.90	250	6.00	790	7.10	1,600	8.20	2,550
5.00	285	6.10	855	7.20	1,685	8.30	2,640
5.10	320	6.20	920	7.30	1,770	8.40	2,730
5.20	360	6.30	985	7.40	1,855	8.50	2,820
5.30	405	6.40	1,050	7.50	1,940	8.60	2,910
5.40	450	6.50	1,120	7.60	2,025	8.70	3,000
5.50	500	6.60	1,195	7.70	2,110	8.80	3,090
5.60	555	6.70	1,270	7.80	2,195		
5.70	610	6.80	1,350	7.90	2,280		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during latter part of 1907 and early part of 1908, and is well defined.

FEBRUARY 2 TO DECEMBER 31, 1908.

3.90	3	5.20	225	6.50	1,090	8.60	2,910
4.00	4	5.30	270	6.60	1,175	8.80	3,090
4.10	6	5.40	320	6.70	1,260	9.00	3,270
4.20	10	5.50	370	6.80	1,345	9.20	3,450
4.30	16	5.60	420	6.90	1,430	9.40	3,630
4.40	25	5.70	480	7.00	1,515	9.60	3,810
4.50	36	5.80	540	7.20	1,685	9.80	3,990
4.60	50	5.90	610	7.40	1,855	10.00	4,170
4.70	67	6.00	690	7.60	2,025	11.00	5,140
4.80	90	6.10	770	7.80	2,195	12.00	6,160
4.90	120	6.20	850	8.00	2,370	13.00	7,220
5.00	150	6.30	930	8.20	2,550	14.00	8,320
5.10	185	6.40	1,010	8.40	2,730		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 11 discharge measurements made during February to December, 1908, and is well defined between gage heights 4.5 feet and 7.5 feet.

Monthly discharge of Puta Creek at Winters, Cal., for 1907 and 1908.

[Drainage area, 805 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	9,360	355	2,320	2.88	3.32	143,000	B.
February	11,300	490	1,860	2.31	2.40	103,000	B.
March	30,000	490	5,150	6.40	7.38	317,000	C.
April	1,890	360	919	1.14	1.27	54,700	B.
May	340	142	230	.286	.33	14,100	A.
June	131	70	110	.137	.15	6,550	A.
July	70	22	39.9	.050	.06	2,450	A.
August	22	10	16.3	.020	.02	1,000	A.
September	22	10	15.1	.019	.02	898	A.
October	22	15	17.7	.022	.03	1,090	A.
November	32	22	24.7	.031	.03	1,470	A.
December	2,740	32	197	.245	.28	12,100	A.
The year	30,000	10	908	1.13	15.29	657,000	
1908.							
January	3,040	185	808	1.00	1.15	49,700	B.
February	8,600	295	1,390	1.73	1.87	80,000	B.
March	3,040	185	662	.822	.95	40,700	B.
April	185	78	130	.161	.18	7,740	B.
May	78	43	64.7	.080	.09	3,980	B.
June	43	10	27.6	.034	.04	1,640	B.
July	10	5	7.32	.0091	.01	450	B.
August	8	4	5.35	.0066	.008	329	B.
September	5	3	3.55	.0044	.005	211	B.
October	4	3	3.61	.0045	.005	222	B.
November	20	4	6.73	.0084	.009	400	B.
December	610	10	138	.171	.20	8,480	B.
The year	8,600	3	271	.337	4.52	194,000	

FEATHER RIVER DRAINAGE BASIN.

DESCRIPTION.

Feather River heads on the crest of the Sierra and takes a general southerly course to its union with the Sacramento about 30 miles south of Marysville and about 15 miles northwest of Sacramento. Its total length is about 175 miles and its drainage area comprises approximately 6,590 square miles, lying on the western slope of the Sierra Nevada, south of the Pit River basin, and north of the American River basin.

From north to south the principal tributaries of Feather River are Indian Creek, Middle Fork, and Yuba and Bear rivers from the east, and Butt Creek and West Branch from the west. Many smaller or less important tributaries enter the main stream and the tributaries.

The basin is roughly triangular in shape, or rather more like a circular sector whose center is at the mouth of Feather River and arc along the crest of the Sierra from Lassen Peak at the north to Mount Lincoln at the northeast. The western leg of the sector is about 150 miles long, the southern leg 90, and the arc 180.

Feather River basin is naturally subdivided into three other comparatively large basins: Yuba River basin at the south, with a total

drainage area of more than 1,300 square miles; Middle Fork basin in the center and at the east, with a total drainage area of about 1,340 square miles; and North Fork basin at the north and west, with a total drainage area of about 2,220 square miles. Yuba basin will be described in connection with the gaging station at Smartsville. Middle Fork basin is long but comparatively narrow except at its east end, where it broadens out and includes Sierra Valley, a large meadow valley at an altitude of 5,000 feet. Beckwith Pass, which opens into this valley from the east, is the lowest pass in the Sierra Nevada, and has an elevation of about 5,200 feet. Sierra Valley and the surrounding country are very dry in the summer. The greatest elevation in the Middle Fork basin is about 8,500 feet.

The drainage basin of the North Fork, here regarded as the main stream, includes the eastern part of Butte, the greater part of Plumas, and the southwestern corner of Lassen counties. The junction of North and Middle forks is in Butte County, about 6 miles northeast of Oroville. The length of North Fork basin does not exceed 75 miles, and its width in Plumas County is about 65 miles.

Above Prattville are two small basins of almost equal size, the eastern being drained by Hamilton Branch and the western by North Fork. The eastern basin ranges in elevation from 4,300 to 7,500 feet, has an area of 230 square miles, and includes the East Arm of Big Meadows and the large, level area called Mountain Meadows. The western basin has an area of 245 square miles, from 4,300 to 10,000 feet in altitude, and includes the West Arm of Big Meadows, and the higher elevations about Lassen Peak. Hamilton Branch and North Fork unite about 3 miles east of Prattville, at the lower end of Big Meadows.

Butt Creek joins North Fork from the west about 12 miles south of Prattville. It has a total drainage area of 74 square miles. Indian Creek enters North Fork from the east about 20 miles southwest of Prattville, and has a total drainage area of about 1,020 square miles.

The greater part of the Feather River drainage area is rough and mountainous and is well trenched by numerous stream channels which drain the slopes of the mountains. The rocks in the southern and eastern parts of the basin are principally granite, with a good soil covering. At the lower elevations some porous and deeply eroded slates and lavas are also found. The northern part of the basin is characterized by cones, craters, deposits of volcanic ash, and lakes, which indicate recent volcanic activity. The basin has a good covering of porous soil, which absorbs the moisture readily and serves to equalize the stream flow. The numerous meadows and valleys that exist in different parts of the area also help to maintain a steady flow during the dry season.

The Feather River drainage basin has a good forest cover, consisting for the most part of brush and scrubby timber on the lower elevations and commercial timber on the mountain sides, except around the summits of the highest peaks like Lassen. About two-thirds of the entire basin, 4,300 square miles in round numbers, is inclosed in national forest reserves, which include all the upper part of the basin except Sierra Valley on Middle Fork, the Meadows around Prattville on North Fork, and a few other very small valleys.

The mean annual precipitation in the Feather basin is about 30 inches in the foothill belt, and increases with elevation to the mountain summits. It ranges from 40 to 60 inches in the North and Middle Fork basins at the north and east, and from 40 to 75 inches at the Yuba basin at the south. In the winter much of it occurs as snowfall which does not disappear from the summits until summer.

Very little irrigation is practiced in the Feather basin. Some water is diverted for use in the small valleys and in the Sacramento Valley below the foothills, but only on a small scale. Considerable water is used for mining and power.

Opportunities for storage in this basin are excellent, especially on the North and Middle forks. Surveys of a large number of reservoir sites in this area have been made by the United States Reclamation Service and many others have been made by private companies.

The minimum flow of the streams in the Feather River basin is sufficient to develop more than half a million horsepower, and this amount could be almost doubled with storage. On North Fork alone about 300,000 horsepower could be developed at low water, and with storage half a million would be available. On Middle Fork only about 66,000 could be developed at low water, and on Yuba River only about 130,000. At the present time the Great Western Power Company is actively engaged in developing its holdings in the North Fork basin.

The basin has many large springs, especially in the lava districts, which supply a more or less steady flow throughout the year. In the North Fork basin, especially, are large perennial springs discharging 50 to 100 second-feet. One of the largest, Dotta Spring, about 3 miles east of Prattville, has a maximum discharge of 100 second-feet and a minimum of 70 second-feet. Many perennial springs are also found in the Yuba basin. The Feather basin also contains many small glacial lakes, chiefly in Yuba and North Fork basins.

The longest run-off record in the Feather basin goes back to 1902. The wettest year since that time was 1907, when a severe flood occurred, and the driest was 1908. The total flow in the driest year was about one-third of that in the wettest. Other historic floods of Feather River occurred in 1849, 1853, 1861, and 1881. At none of

these, however, was the stage at Oroville so high as in March, 1907. This may have been due in part or entirely to the absence of mining débris which has been filling the channel at or below Oroville during recent years.

The following gaging stations have been maintained in the Feather River drainage basin:

North Fork of Feather River above Prattville (1905 to 1907).
North Fork of Feather River below Prattville (1905 to 1908).
North Fork of Feather River near Big Bend (1905 to 1908).
Feather River at Oroville (1902 to 1908).
Hamilton Branch near Prattville (1905 to 1907).
Butt Creek near Butte Valley (1905 to 1908).
Indian Creek near Crescent Mills (1905 to 1908).
Yuba River near Smartsville (1903 to 1908).
Bear River at Van Trent, above Wheatland (1904 to 1908).

NORTH FORK OF FEATHER RIVER ABOVE PRATTVILLE, CAL.

This station, which was established June 12, 1905, to determine the availability of the North Fork for power development, is located 3 miles east of Prattville and about 1,300 feet above the junction with Hamilton Branch. The drainage area above the station is 245 square miles. This station was discontinued July 1, 1907.

The channel has a shale bottom subject to slight change. At low water it is about 65 feet wide and 5 feet deep; at high water there is a diversion overflow around the station, leaving the main stream about 1½ miles above the point of measurement.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station from the date of its establishment:

Discharge measurements of North Fork of Feather River above Prattville, Cal., in 1905 and 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 12	R. W. Armstrong	2.33	890	February 28	L. J. Bevan	1.82	669
June 22	W. E. Spear	1.79	620	April 12	do	2.77	1,046
July 1	do	1.48	520	May 15	do	3.83	1,524
July 15	R. W. Armstrong	1.23	407	July 7	do	2.48	929
July 28	W. E. Spear	1.09	399	August 8	do	1.34	502
August 15	L. J. Bevan	.99	370				
September 4	do	.90	345				
December 17	do	.80	330				

Daily gage height, in feet, of North Fork of Feather River above Prattville, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1						3.17	16		1.55	1.43			
2		2.76	1.81				17						
3							18					3.98	
4				2.50	3.88		19	1.00					
5	1.04						20						
6							21						
7							22						
8							23		2.25				
9		2.50	1.76				24						
10							25					3.12	
11					3.93		26	1.02					
12	1.02			3.53			27						
13							28						
14							29						2.55
15							30						
							31						

Rating tables for North Fork of Feather River above Prattville, Cal.

FOR 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	325	1.20	425	1.60	550	1.90	660
.90	345	1.30	455	1.70	585	2.00	700
1.00	370	1.40	485	1.80	620	2.10	740
1.10	395	1.50	515				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1905 and is well defined.

FOR 1906 AND 1907.

0.80	350	1.70	620	2.60	975	3.50	1,370
.90	375	1.80	655	2.70	1,015	3.60	1,415
1.00	400	1.90	695	2.80	1,055	3.70	1,465
1.10	425	2.00	735	2.90	1,100	3.80	1,515
1.20	450	2.10	775	3.00	1,145	3.90	1,565
1.30	480	2.20	815	3.10	1,190	4.00	1,615
1.40	515	2.30	855	3.20	1,235	4.10	1,665
1.50	550	2.40	895	3.30	1,280	4.20	1,715
1.60	585	2.50	935	3.40	1,325		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1906 and the form of the 1905 curve at low water and is well defined above gage height 1.3 feet.

Monthly discharge of North Fork of Feather River above Prattville, Cal., for 1905 to 1907.

[Drainage area, 245 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
June 17-30	732	518	611	2.49	1.30	17,000	A.
July	515	385	436	1.78	2.05	26,800	A.
August	385	345	365	1.49	1.72	22,400	A.
September	358	329	341	1.39	1.55	20,300	A.
October	345	333	338	1.38	1.59	20,800	A.
November	339	329	332	1.36	1.52	19,800	A.
December	340	315	326	1.33	1.53	20,000	A.
The period						147,000	

Monthly discharge of North Fork of Feather River above Prattville, Cal., for 1905 to 1907—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	613	340	442	1.80	2.08	27,200	B.
February	695	448	553	2.26	2.35	30,700	B.
March	971	515	668	2.73	3.15	41,100	B.
April	1,060	655	923	3.77	4.21	54,900	B.
May	1,690	1,020	1,360	5.55	6.40	83,600	A.
June	1,460	963	1,200	4.90	5.47	71,400	A.
July	960	530	730	2.98	3.44	44,900	A.
August	530	440	471	1.92	2.21	29,000	B.
September	430	380	404	1.65	1.84	24,000	B.
October	390	365	373	1.52	1.75	22,900	B.
November	500	388	404	1.65	1.84	24,000	B.
December	951	385	522	2.13	2.46	32,100	B.
The year	1,690	340	671	2.74	37.20	486,000	
1907.							
January	585	375	425	1.73	1.99	26,100	B.
February	2,400	568	974	3.98	4.14	54,100	A.
March	3,900	515	1,350	5.51	6.35	83,000	C.
April	2,400	935	1,450	5.92	6.60	86,300	B.
May	1,700	1,200	1,490	6.08	7.01	91,600	A.
June	1,370	955	1,150	4.69	5.23	68,400	B.
The period						410,000	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. The daily discharge for days when there were no gage readings was estimated with the aid of a hydrograph, following the rise and fall at the station below Prattville, where daily observations were obtained most of the time. The sum of the monthly means for this station and the one on Hamilton Branch have been compared with those for the station below Prattville, and the ratios indicate that the values as a whole are good. Gage heights for 1905 and 1906 are given in Water-Supply Paper 213, pp. 129–130.

NORTH FORK OF FEATHER RIVER BELOW PRATTVILLE, CAL.

This station was established November 22, 1905, to determine the quantity of water available for storage and power development at the dam site. Previous to that date, however, the Great Western Power Company had installed a gage rod and maintained a daily record since June 13, 1905, making gagings by means of a boat. The station is located in the canyon at the proposed dam site of the Great Western Power Company, about 3 miles below the Meadow View bridge crossing on the Prattville-Greenville road, and about 5 miles southeast of Prattville. Gagings are made from a cable.

Butt Creek enters from the west about 5 miles below the station, and Indian Creek from the east about 15 miles below, and North Fork and Hamilton Branch unite about 5 miles above.

The Great Western Power Company probably owns all the water rights above this station.

Thin sheet ice is formed occasionally, but does not affect the records.

The gage datum has remained unchanged during the life of the station and the record is good. The bed is rocky and is not likely to change materially. The current is swift at high water, but has moderate velocity at other stages. At low water the stream is about 60 feet wide and has a maximum depth of 9 feet.

During the past two years this station has been maintained by the Great Western Power Company under the direction of Viele, Blackwell, and Buck, who have furnished the following data through L. J. Bevan, the company's hydrographer.

Discharge measurements of North Fork of Feather River below Prattville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.
1907.		*Feet.*	*Sec.-ft.*
January 22	L. J. Bevan	2.22	722
April 22	do	7.64	3,680
July 23	do	3.30	1,130
August 27	do	2.77	900
1908.			
August 17	L. J. Bevan	2.23	701

Daily gage height, in feet, of North Fork of Feather River below Prattville, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.20	4.20	4.25	5.60	7.25	6.80	4.40	3.10	2.65	2.45	2.55	2.35
2	2.90	6.50	4.05	5.55	7.10	6.85	4.25	3.05	2.65	2.45	2.55	2.35
3	2.80	8.35	3.95	5.50	7.10	6.85	4.20	3.05	2.65	2.45	2.50	2.35
4	2.50	9.45	3.90	5.45	7.50	6.80	4.15	3.05	2.65	2.45	2.45	2.40
5	2.40	9.30	4.00	5.50	7.00	6.70	4.10	3.00	2.65	2.45	2.40	2.45
6	2.50	9.10	4.05	5.55	6.95	6.50	4.05	3.00	2.65	2.45	2.40	2.55
7	2.50	8.10	3.85	5.70	6.95	6.50	4.00	3.00	2.65	2.40	2.35	3.20
8	2.50	6.80	3.68	5.80	6.85	6.30	3.90	3.00	2.65	2.40	2.35	3.25
9	2.50	5.60	3.70	5.80	6.90	6.00	3.85	2.95	2.60	2.40	2.35	3.20
10	2.50	5.18	3.70	5.85	7.00	5.75	3.80	2.95	2.60	2.40	2.40	3.20
11	2.50	4.85	3.65	6.50	7.25	6.30	3.75	2.95	2.60	2.40	2.40	3.45
12	2.50	4.60	3.45	7.25	7.25	7.25	3.70	2.90	2.55	2.40	2.35	3.25
13	2.45	4.40	3.35	7.65	7.30	7.05	3.65	2.90	2.55	2.40	2.35	3.25
14	2.45	4.22	3.30	[a] 8.55	6.85	6.90	3.60	2.90	2.55	2.60	2.35	3.00
15	2.40	4.15	3.40	9.50	6.85	6.80	3.60	2.85	2.55	2.55	2.35	2.80
16	2.35	4.15	4.50	8.85	6.90	6.70	3.55	2.85	2.55	2.55	2.30	2.70
17	2.30	4.10	8.40	8.15	7.00	6.60	3.50	2.85	2.55	2.50	2.30	2.65
18	[a] 2.27	4.25	13.00	[a] 8.00	7.00	6.50	3.45	2.80	2.55	2.45	2.40	2.55
19	2.25	4.25	16.00	7.90	7.20	6.40	3.45	2.80	2.55	2.40	2.40	2.50
20	2.26	4.25	14.60	8.25	7.50	6.30	3.40	2.80	2.50	2.40	2.35	2.40
21	2.30	4.25	12.00	7.90	7.40	6.20	3.35	2.75	2.50	2.40	2.30	2.40
22	2.30	4.35	8.50	7.64	7.30	6.10	3.30	2.75	2.50	2.45	2.30	2.47
23	2.34	4.40	6.40	7.60	7.20	6.00	3.25	2.75	2.45	2.45	2.35	2.55
24	2.35	4.50	6.30	7.70	7.10	4.95	3.25	2.75	2.45	2.45	2.35	2.57
25	2.35	4.80	6.30	7.85	7.05	4.85	3.20	2.75	2.45	2.40	2.35	2.57
26	2.40	4.75	6.25	7.50	7.00	4.80	3.20	2.75	2.40	2.45	2.35	3.10
27	2.45	4.43	6.10	7.40	6.90	4.70	3.15	2.75	2.40	2.50	2.30	4.05
28	2.55	4.20	6.00	7.40	6.80	4.70	3.15	2.70	2.45	2.50	2.30	4.00
29	2.73	.....	5.90	7.35	6.70	4.60	3.15	2.70	2.45	2.50	2.30	3.00
33	2.80	.....	5.75	7.40	6.65	4.30	3.10	2.70	2.45	2.60	2.25	2.25
31	3.25	.....	5.70	.....	6.60	.....	3.10	2.70	.....	2.70	.....	2.30

[a] Estimated.

Daily gage height, in feet, of North Fork of Feather River below Prattville, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.27	2.45	2.18	3.46	4.17	.....	2.56	[a] 2.05	1.99	1.93	2.07	1.99
2	2.57	2.10	2.24	3.42	4.44	.....	2.58	.....	1.95	1.93	2.02	2.00
3	2.43	2.23	2.48	3.52	4.38	.....	2.54	.....	1.96	1.93	2.00	2.03
4	2.48	2.50	2.38	3.70	4.13	.....	2.50	.....	1.98	1.93	1.98	2.30
5	2.48	2.45	2.39	3.86	3.92	.....	2.49	.....	1.98	1.93	1.98	2.30
6	2.45	2.47	2.33	3.88	3.85	3.38	2.47	[a] 2.04	1.98	1.92	1.96	2.28
7	2.44	2.51	2.34	3.68	3.96	3.40	2.44	.....	1.99	1.92	1.95	2.15
8	2.45	2.50	2.34	3.51	4.16	3.45	2.40	.....	1.96	1.93	1.98	2.12
9	2.43	2.43	2.40	3.52	3.91	3.42	2.37	.....	1.95	1.93	1.98	2.08
10	2.42	2.42	2.45	3.60	3.75	3.40	2.40	.....	1.95	1.93	1.98	2.02
11	2.45	2.43	2.50	3.71	3.76	3.42	2.36	[a] 2.03	1.94	1.95	1.97	1.93
12	2.45	2.40	2.60	3.84	3.95	3.44	2.36	.....	1.95	1.95	1.97	1.98
13	2.50	2.35	2.66	4.02	3.84	3.45	2.33	.....	1.98	1.94	1.96	1.96
14	2.77	2.34	2.84	4.14	3.88	3.50	2.30	.....	1.98	1.97	1.96	1.96
15	2.91	2.33	3.03	4.25	4.24	3.54	2.27	.....	1.96	2.58	1.95	1.88
16	2.91	2.32	3.26	4.36	4.33	3.45	2.25	[a] 2.07	2.02	2.46	1.95	1.87
17	2.89	2.35	3.57	4.34	4.22	3.32	2.22	.....	2.03	2.18	1.94	1.86
18	2.97	2.30	3.95	4.33	4.20	3.20	2.18	.....	2.00	2.10	1.94	1.83
19	3.15	2.29	4.14	4.23	4.31	3.08	2.18	.....	1.98	2.07	1.94	1.83
20	3.30	2.30	4.17	4.38	4.23	3.02	2.16	.....	1.98	2.05	2.05	1.84
21	3.32	2.30	4.15	4.58	4.00	3.08	2.13	[a] 2.00	1.95	2.02	2.40	1.83
22	3.37	2.32	4.17	4.62	3.90	3.11	2.14	.....	1.94	1.99	2.46	1.85
23	3.32	2.37	4.18	4.50	3.89	2.98	2.11	.....	1.93	1.98	2.50	1.86
24	3.38	2.41	4.21	4.32	3.92	2.86	2.10	.....	1.93	1.98	2.35	1.86
25	3.17	2.46	4.41	4.33	4.00	2.77	2.10	.....	1.93	1.98	2.23	1.86
26	3.02	2.53	4.33	4.25	4.07	2.73	.....	.....	1.93	1.98	2.10	1.86
27	2.90	2.70	4.11	4.15	4.02	2.68	.....	.....	1.84	1.97	2.02	.....
28	2.77	2.73	3.88	4.13	3.87	2.65	.....	.....	1.94	1.97	2.00	.....
29	2.64	2.58	3.72	4.16	3.89	2.61	[a] 2.07	2.00	1.93	1.99	1.99	.....
30	2.60	.....	3.70	4.11	3.96	2.58	.....	2.00	1.93	2.14	1.99	.....
31	2.52	.....	3.58	.....	.....	.....	.....	2.00	.....	2.13	.....	.....

[a] Estimated.

Rating table for North Fork of Feather River below Prattville, Cal., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.75	535	3.20	1,094	4.70	1,832	7.40	3,466
1.80	553	3.30	1,140	4.80	1,885	7.60	3,603
1.90	589	3.40	1,188	4.90	1,939	7.80	3,743
2.00	625	3.50	1,236	5.00	1,993	8.00	3,882
2.10	661	3.60	1,283	5.20	2,102	9.00	4,575
2.20	697	3.70	1,331	5.40	2,214	10.00	5,283
2.30	733	3.80	1,380	6.60	2,327	11.00	6,007
2.40	770	3.90	1,428	5.80	2,444	12.00	6,743
2.50	818	4.00	1,477	6.00	2,564	13.00	7,495
2.60	846	4.10	1,527	6.20	2,686	14.00	8,263
2.70	884	4.20	1,577	6.40	2,821	15.00	9,047
2.80	924	4.30	1,627	6.60	2,938	16.00	9,847
2.90	964	4.40	1,677	6.80	3,067	17.00	10,663
3.00	1,006	4.50	1,728	7.00	3,198		
3.10	1,049	4.60	1,780	7.20	3,331		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is well defined between gage heights 1.9 feet and 7.7 feet.

Monthly discharge of North Fork of Feather River below Prattville, Cal., for 1907 and 1908.

[Drainage area, 506 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,120	715	814	1.61	1.86	50,100	A.
February	4,890	1,530	2,300	4.55	4.74	128,000	A.
March	9,850	1,140	2,800	5.53	6.38	172,000	A.
April	4,930	2,240	3,290	6.50	7.25	196,000	A.
May	3,530	2,940	3,230	6.38	7.36	199,000	A.
June	3,360	1,630	2,650	5.24	5.85	158,000	A.
July	1,680	1,050	1,280	2.53	2.92	78,700	A.
August	1,050	884	951	1.88	2.17	58,500	A.
September	865	770	826	1.63	1.82	49,200	A.
October	884	770	794	1.57	1.81	48,800	A.
November	827	715	758	1.50	1.67	45,100	A.
December	1,500	715	939	1.86	2.14	57,700	A.
The year	9,850	715	1,720	3.40	45.97	1,240,000	
1908.							
January	1,180	721	917	1.81	2.09	56,400	A.
February	1,880	660	809	1.60	1.73	46,500	A.
March	1,680	711	1,140	2.25	2.59	70,100	A.
April	1,790	1,200	1,500	2.96	3.30	89,300	A.
May	1,700	1,360	1,500	2.96	3.41	92,200	A.
June	1,400	839	1,110	2.19	2.44	66,000	A.
July	839	640	723	1.43	1.65	44,500	A.
August	650	625	635	1.25	1.44	39,000	C.
September	636	598	610	1.21	1.35	36,300	C.
October	840	595	632	1.25	1.44	38,900	A.
November	809	602	647	1.28	1.43	38,500	A.
December	733	562	612	1.21	1.40	37,600	A.
The year	1,880	562	903	1.78	24.27	655,000	

NOTE.—Values for 1908 are based on daily discharges computed for the Great Western Power Company. Practically the same rating table was used as for 1907.

NORTH FORK OF FEATHER RIVER NEAR BIG BEND, CAL.

This station, which was established June 13, 1905, to determine the availability of the North Fork for power development, is located about 300 feet above the head of Big Bend tunnel and about 20 miles north of Oroville.

No important tributaries enter for many miles above the station. West Branch enters from the west about 10 miles below the station by river, and Middle Fork comes in from the east about 20 miles below.

During 1908 the gage was changed several times, owing to construction work about the head of Big Bend tunnel.

The stream has a rock channel which is practically permanent. At low water the stream is about 85 feet wide and 19 feet deep and has a sluggish but uniform current.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of North Fork of Feather River near Big Bend, Cal., in 1905 to 1908.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1907.		*Feet.*	*Sec.-ft.*
June 13	W. E. Spear	4.15	3,750	March 18 [a]	L. J. Bevan	31.00	91,000
July 13	do	2.75	1,352	July 5	do	4.99	3,267
August 20	L. J. Bevan	2.14	1,048	August 13	do	3.18	1,750
September 16	do	2.07	1,003	August 21	do	2.96	1,654
October 22	do	2.15	1,038	October 9	do	2.66	1,364
December 5	do	2.25	1,101				
1906.				1908.			
February 2	L. J. Bevan	4.79	3,017	July 14	L. J. Bevan	[b] 1.82	1,418
March 13	do	12.25	13,230	July 22	do	[b] 1.40	1,181
April 18	do	10.24	9,962	September 8	do	[b] 1.00	1,005
April 28	do	8.98	8,052	October 15	do	[b] 2.28	1,741
June 6	do	9.55	8,655				
June 7	do	9.08	8,332				
July 13	do	4.73	3,081				
August 12	do	3.03	1,677				
October 11	do	2.44	1,269				

[a] Float measurement. [b] New gage since 1907.

Daily gage height, in feet, of North Fork of Feather River near Big Bend, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.85	12.60	8.50	.....	10.90	9.20	5.50	3.60	2.95	2.70	3.28	2.85
2	5.35	20.95	8.50	.....	10.65	9.30	5.40	3.55	2.95	2.72	3.18	2.86
3	5.25	19.85	8.00	.....	10.60	9.20	5.30	3.50	2.95	2.72	3.25	2.85
4	6.00	17.50	8.00	.....	10.30	9.10	5.20	3.45	2.95	2.72	3.02	2.95
5	6.35	16.50	8.50	.....	10.20	8.70	5.05	3.35	2.95	2.72	2.92	3.00
6	5.65	15.50	8.50	.....	9.95	8.50	5.00	3.30	2.95	2.72	2.90	3.50
7	5.15	13.00	8.00	.....	9.80	8.30	4.90	3.30	2.95	2.75	2.90	6.30
8	4.85	11.50	7.50	.....	9.80	8.20	4.80	3.25	2.90	2.75	2.90	5.45
9	4.70	10.50	8.50	.....	9.80	7.70	4.70	3.20	2.85	2.75	2.90	4.60
10	4.85	9.00	8.00	.....	10.00	7.60	4.60	3.20	2.80	2.80	2.86	5.35
11	4.70	9.00	7.50	.....	10.70	9.60	4.55	3.20	2.80	2.87	2.90	6.15
12	4.55	8.50	7.00	.....	10.45	8.60	4.45	3.15	2.80	2.90	2.94	4.70
13	4.45	8.00	6.50	.....	9.95	8.50	4.35	3.15	2.77	2.87	2.85	4.82
14	4.30	7.50	6.10	.....	9.60	8.30	4.20	3.15	2.77	2.85	2.85	4.58
15	4.35	8.05	6.55	.....	9.50	7.70	4.15	3.10	2.75	2.82	2.82	4.12
16	4.15	8.50	6.60	.....	9.40	7.30	4.15	3.05	2.75	2.80	2.85	3.98
17	4.10	9.00	13.00	.....	9.10	6.90	4.10	3.05	2.77	2.80	2.90	3.68
18	4.10	9.05	31.00	.....	9.70	6.80	4.05	3.05	2.80	2.80	2.95	3.58
19	4.00	8.50	[a] 34.50	.....	11.30	6.70	4.00	3.07	2.80	2.80	2.95	3.52
20	3.95	8.50	28.00	.....	10.60	6.70	3.90	2.97	2.80	2.80	2.94	3.50
21	3.90	8.05	22.00	13.45	10.30	6.60	3.85	2.97	2.75	2.85	2.91	3.42
22	3.90	9.50	18.00	13.37	9.70	6.50	3.80	2.95	2.72	2.85	2.92	3.38
23	3.90	9.50	15.00	13.20	9.10	6.50	3.75	2.95	2.70	2.85	2.94	3.45
24	3.95	9.05	12.00	.....	8.80	6.40	3.70	2.95	2.70	2.90	2.98	3.48
25	4.40	9.80	10.00	.....	8.80	6.20	3.70	2.95	2.70	2.95	2.98	3.48
26	4.55	9.05	[b] 9.80	.....	8.70	6.10	3.65	2.95	2.70	3.05	2.98	6.10
27	4.90	8.50	[b] 9.60	.....	8.80	5.90	3.65	2.95	2.70	3.05	2.90	7.60
28	7.30	8.00	[b] 9.40	.....	8.80	5.95	3.65	2.95	2.70	3.05	2.94	6.85
29	8.05	.....	[b] 9.20	.....	8.90	5.80	3.65	2.95	2.70	2.98	2.95	[b] 6.60
30	7.50	.....	[b] 9.10	11.10	8.90	5.80	3.65	2.95	2.70	3.30	2.89	[b] 6.55
31	8.65	.....	[b] 9.00	.....	9.10	.....	3.65	2.95	.....	3.28	.....	[b] 6.50

[a] The highest crest stage of 36.0 feet occurred at 1 a. m. March 19.
[b] Estimated.

Rating table for North Fork of Feather River near Big Bend, Cal., for 1905 to 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	995	3.90	2,335	6.60	4,980	20.00	38,600
2.10	1,040	4.00	2,420	6.80	5,220	21.00	43,800
2.20	1,100	4.10	2,510	7.00	5,470	22.00	47,200
2.30	1,160	3.20	2,600	7.20	5,720	23.00	51,800
2.40	1,220	4.30	2,690	7.40	5,970	24.00	56,500
2.50	1,280	4.40	2,780	7.60	6,230	25.00	61,200
2.60	1,340	4.50	2,870	7.80	6,490	26.00	65,800
2.70	1,405	4.60	2,960	8.00	6,760	27.00	70,700
2.80	1,470	4.70	3,060	9.00	8,170	28.00	75,700
2.90	1,545	4.80	3,150	10.00	9,650	29.00	80,700
3.00	1,615	4.90	3,240	11.00	11,400	30.00	85,700
3.10	1,690	5.00	3,340	12.00	13,300	31.00	90,800
3.20	1,765	5.20	3,530	13.00	15,600	32.00	96,000
3.30	1,840	5.40	3,730	14.00	18,300	33.00	101,300
3.40	1,920	5.60	3,930	15.00	21,200	34.00	106,700
3.50	2,000	5.80	4,130	16.00	24,300	35.00	112,000
3.60	2,080	6.00	4,340	17.00	27,500	36.00	117,500
3.70	2,165	6.20	4,550	18.00	30,900		
3.80	2,250	6.40	4,760	19.00	34,600		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty discharge measurements made in 1905 to 1907 and is well defined between gage heights 2.0 feet and 13.0 feet, and fairly well above 13.0 feet.

Daily discharge, in second-feet, of North Fork of Feather River near Big Bend, Cal., for 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,730	3,010	3,530	4,550	5,540	4,815	2,290	1,030	980	980	1,540	.....
2	3,480	3,060	3,480	4,285	5,535	4,815	2,280	1,020	980	980	1,180	.....
3	2,910	3,430	3,340	4,130	5,280	4,760	2,250	1,020	970	980	1,180	.....
4	2,960	3,340	3,530	4,390	.....	4,180	2,250	1,009	970	980	1,190	.....
5	2,870	3,290	3,480	4,705	5,040	4,080	2,210	1,009	970	990	1,130	.....
6	2,690	3,240	2,915	.....	4,815	4,080	2,120	1,000	980	990	1,088	.....
7	2,360	3,340	2,825	5,040	4,760	4,180	2,080	998	1,006	990	1,096	1,580
8	2,380	3,480	2,825	4,650	.....	4,080	2,080	998	1,006	980	1,096	.....
9	2,870	3,730	2,825	4,695	4,815	3,980	2,040	994	980	980	1,088	.....
10	2,650	3,530	2,915	4,925	4,705	3,880	.....	994	980	980	1,088	.....
11	2,560	3,390	3,010	5,535	4,705	3,980	.....	1,000	970	980	1,088	.....
12	2,600	3,200	3,010	5,915	4,760	4,080	.....	1,006	970	980	1,096	.....
13	3,100	3,200	3,195	6,490	4,705	4,080	.....	1,006	970	980	1,096	.....
14	5,250	2,830	3,290	6,690	5,535	.....	.....	1,070	970	990	1,088	.....
15	4,500	2,830	3,565	6,830	5,410	4,080	.....	1,060	980	2,510	1,088	.....
16	4,140	2,740	5,785	7,690	5,505	3,880	.....	1,060	960	1,830	1,088	.....
17	3,630	2,740	6,425	4,925	5,160	3,980	.....	1,030	1,040	1,400	1,096	.....
18	3,730	2,640	6,190	6,425	5,285	3,880	.....	1,060	1,050	1,300	1,088	.....
19	4,280	2,550	6,555	6,165	5,285	3,780	.....	1,050	1,030	1,220	1,060	.....
20	5,230	2,400	6,425	6,040	5,535	3,580	.....	1,060	1,006	1,180	1,182	.....
21	5,940	2,460	6,165	6,830	5,535	3,580	.....	990	1,006	1,130	1,540	1,175
22	6,100	2,420	6,100	6,830	5,160	3,480	1,170	980	1,006	1,130	2,650	.....
23	5,340	2,560	6,165	6,690	5,280	3,290	1,170	980	980	1,100	2,370	1,165
24	5,400	2,560	6,000	6,105	5,100	3,105	.....	980	980	1,100	2,060	1,172
25	4,760	2,460	6,425	6,040	5,160	2,915	.....	980	970	1,100	1,683	1,165
26	4,290	2,740	6,330	5,980	5,220	2,735	.....	980	970	1,088	1,427	1,096
27	3,880	2,640	6,285	5,785	5,160	2,465	1,098	980	980	1,088	1,290	1,233
28	3,630	3,430	4,695	5,535	5,040	.....	1,010	980	980	1,085	1,240	1,047
29	3,400	3,480	5,345	5,405	4,980	.....	1,020	980	980	1,040	.....	1,126
30	3,200	.....	4,925	5,535	5,040	2,380	1,008	980	980	1,580	.....	1,100
31	2,960	.....	4,705	.....	4,925	.....	1,025	980	.....	1,560	.....	1,119

NOTE.—These discharges were computed and furnished by the Great Western Power Company. Discharges have been interpolated for missing days in computing monthly means.

Monthly discharge of North Fork of Feather River near Big Bend, Cal., for 1905 to 1908.

[Drainage area, 1,940 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
July 13-31	1,440	1,120	1,280	0.660	0.47	48,200	A.
August	1,160	1,020	1,080	.557	.64	66,400	A.
September	1,190	1,010	1,030	.531	.59	61,300	A.
October	1,110	1,030	1,060	.546	.63	65,200	A.
November	1,320	1,080	1,120	.577	.64	66,600	A.
December	1,380	1,040	1,150	.593	.68	70,700	A.
The period	.....	.....	.....	.....	.....	378,400	
1906.							
January	38,400	1,120	6,490	3.35	3.86	399,000	A.
February	9,350	2,870	5,150	2.65	2.76	286,000	A.
March	20,300	4,830	9,680	4.99	5.75	595,000	A.
April	13,200	7,320	9,910	5.11	5.70	590,000	A.
May	13,000	6,100	9,430	4.86	5.60	580,000	A.
June	11,800	3,720	7,570	3.90	4.35	450,000	A.
July	4,600	1,840	2,980	1.54	1.78	183,000	A.
August	1,800	1,360	1,540	.794	.92	94,700	A.
September	1,350	1,280	1,310	.675	.75	78,000	A.
October	1,270	1,220	1,240	.639	.74	76,200	A.
November	4,230	1,220	1,610	.830	.93	95,800	A.
December	22,400	1,250	4,070	2.10	2.42	250,000	A.
The year	38,400	1,120	5,080	2.62	35.56	3,680,000	
1907.							
January	7,660	2,340	3,510	1.81	2.09	216,000	A.
February	43,800	6,100	12,900	6.65	6.92	716,000	A.
March	109,000	4,440	18,300	9.43	10.87	1,130,000	B.
April	.....	.....	[a] 13,800	7.11	7.93	821,000	B.
May	12,000	7,750	9,330	4.81	5.54	574,000	A.
June	9,060	4,130	6,250	3.22	3.59	372,000	A.
July	3,830	2,120	2,700	1.39	1.60	166,000	A.
August	2,080	1,580	1,720	.887	1.02	106,000	A.
September	1,580	1,400	1,470	.758	.85	87,500	A.
October	1,840	1,400	1,520	.784	.90	93,500	A.
November	1,820	1,490	1,580	.814	.91	94,000	A.
December	6,240	1,500	2,980	1.54	1.78	183,000	A.
The year	109,000	1,400	6,340	3.27	44.00	4,560,000	
1908.							
January	6,100	2,360	3,770	1.94	2.24	232,000	A.
February	3,730	2,400	2,990	1.54	1.66	172,000	A.
March	6,560	2,820	4,590	2.37	2.73	282,000	A.
April	7,690	4,130	5,660	2.92	3.26	337,000	A.
May	5,540	4,705	5,130	2.64	3.04	315,000	A.
June	4,820	2,380	3,700	1.91	2.13	220,000	A.
July	2,290	1,010	1,590	.820	.95	97,800	A.
August	1,070	980	1,010	.521	.60	62,100	A.
September	1,050	960	987	.509	.57	58,700	A.
October	2,510	980	1,190	.613	.71	73,200	A.
November	2,650	1,060	1,310	.675	.75	78,000	A.
December	1,580	1,050	1,300	.670	.77	79,900	A.
The year	7,690	960	2,770	1.43	19.41	2,010,000	

[a] Estimated.

NOTE.—Discharges for 1905 to 1907 were computed by the United States Geological Survey from data furnished by the Great Western Power Company.

FEATHER RIVER AT OROVILLE, CAL.

This station, which was established January 1, 1902, to obtain data for use in studies of flood and reclamation problems in the Sacramento Valley, was originally placed at the Oroville highway bridge, and measurements were made from a boat about 500 feet above the bridge. In February, 1905, a cable was placed across the river about 1,000 feet above the bridge. In December, 1905, a staff gage was also placed near the cable on the left bank.

The station was completely destroyed by the flood of March, 1907, which took away the gage and the cable. A new gage, referred to the old datum, was put in on April 8, 1907, 1,000 feet above the highway bridge, and a new cable was placed across the river October 10, 1907, about 125 feet below the old one.

The station is about 6 miles below the junction of North and Middle forks, and about 30 miles above the mouth of Yuba River, which enters at Marysville. No other important tributaries enter near the station.

No diversions are made immediately above the station. All acquired water rights are probably for power development.

Conditions for obtaining accurate discharge measurements at high stages are poor, because the channel has a changeable bed and rough, rocky banks, and the current is very swift. At other stages the discharge data are fairly reliable, though the channel is subject to change and frequent gagings are necessary. At low water the stream is about 280 feet wide and from 10 to 15 feet deep, and the current is sluggish.

Discharge measurements of Feather River at Oroville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9	R. S. Hawley	315	5,640	12.15	19,900
February 22	do	307	5,040	10.50	16,900
March 8	do	292	4,630	9.18	13,400
October 11	W. A. Lamb	290	2,880	6.00	1,630
October 24	do	285	2,790	6.02	1,650
1908.					
January 19	W. A. Lamb	295	3,730	8.73	8,400
February 2	do	295	3,620	8.30	7,340
February 21	do	290	3,240	7.02	3,810
April 6	do	295	3,680	8.62	7,980
April 13	do	295	4,060	9.80	11,700
April 21	do	295	4,150	10.10	13,000
September 23	W. V. Hardy	270	2,570	4.85	1,180
December 17	W. F. Martin	278	2,750	5.31	1,790

Daily gage height, in feet, of Feather River at Oroville, Cal., for 1907 and 1908.

[P. H. Bole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.2	11.5	9.0	13.0	12.8	11.3	8.5	7.0	6.0	6.1	6.4	6.0
2	5.8	17.5	9.55	13.0	12.7	11.0	8.4	7.0	6.0	6.1	6.3	6.0
3	5.65	22.1	10.75	13.25	12.7	10.6	8.3	7.0	6.0	6.1	6.3	6.0
4	9.0	19.0	11.4	13.0	12.6	10.5	8.2	6.8	6.1	6.1	6.2	6.0
5	7.0	17.5	12.5	13.0	13.0	10.7	8.2	6.7	6.1	6.1	6.2	6.1
6	6.0	15.5	10.1	12.9	12.9	10.7	8.1	6.6	6.1	6.1	6.1	6.2
7	7.5	14.0	9.4	12.9	12.8	10.7	8.1	6.6	6.1	6.1	6.1	8.6
8	6.0	12.8	8.0	13.5	12.8	10.8	8.1	6.6	6.1	6.1	6.1	8.3
9	5.7	11.8	8.4	13.3	12.7	10.8	8.1	6.6	6.5	6.1	6.0	7.3
10	5.3	11.0	9.45	13.2	12.6	11.0	8.1	6.5	6.3	6.1	6.0	8.0
11	6.8	10.0	9.1	13.2	12.6	11.0	8.0	6.5	6.2	6.1	6.0	8.0
12	6.2	9.0	9.0	13.4	12.4	11.1	8.0	6.5	6.2	6.1	6.0	8.7
13	5.8	7.8	8.35	13.6	12.1	13.0	7.9	6.5	6.2	6.1	6.0	7.6
14	5.65	7.5	7.95	13.7	12.0	12.2	7.9	6.5	6.2	6.1	6.0	7.0
15	9.0	7.3	7.6	14.0	11.9	11.8	7.8	6.5	6.1	6.0	6.0	7.4
16	7.0	7.0	7.5	14.5	11.6	11.0	7.8	6.5	6.1	6.0	6.0	8.0
17	6.0	10.0	14.7	15.7	11.5	11.1	7.8	6.4	6.1	6.0	6.1	8.0
18	5.85	9.5	32.4	15.6	11.5	11.0	7.8	6.4	6.1	6.0	6.1	7.9
19	5.0	9.0	39.3	16.0	12.0	10.6	7.8	6.4	6.1	6.0	6.0	8.1
20	4.7	8.6	28.6	15.3	13.5	10.2	7.7	6.4	6.1	6.0	6.0	8.8
21	4.3	8.3	24.3	14.6	13.5	9.8	7.6	6.4	6.1	6.0	6.0	9.0
22	4.0	8.3	19.95	14.1	13.4	9.85	7.5	6.3	6.1	6.0	6.0	8.6
23	4.2	10.6	18.75	13.8	13.2	9.7	7.5	6.3	6.1	6.0	6.0	8.6
24	4.35	9.3	15.65	13.3	13.0	9.6	7.5	6.2	6.1	6.0	6.0	8.7
25	5.0	10.5	14.55	13.05	12.5	9.5	7.4	6.2	6.1	6.0	6.0	8.0
26	6.0	10.05	13.85	13.0	12.0	9.4	7.4	6.2	6.1	6.2	6.0	7.6
27	8.0	9.2	13.35	13.0	12.1	9.2	7.3	6.2	6.1	6.2	6.0	7.6
28	9.3	8.6	13.15	13.0	12.1	9.1	7.5	6.2	6.1	6.2	6.0	8.0
29	9.0	.....	13.15	13.0	12.0	9.0	7.2	6.2	6.1	6.2	6.0	8.8
30	8.5	.....	13.0	12.90	11.8	8.8	7.2	6.1	6.1	6.5	6.0	9.1
31	9.0	.....	13.0	.....	11.7	.....	7.1	6.1	.....	6.4	.....	8.6
1908.												
1	7.6	9.0	8.0	8.0	9.0	8.1	6.5	5.6	4.9	4.9	5.3	5.3
2	7.0	10.5	7.9	8.0	8.8	8.0	6.4	5.6	4.9	4.9	5.2	5.3
3	7.0	11.0	7.8	7.9	8.6	8.0	6.3	5.6	4.9	4.9	5.1	5.5
4	6.8	10.4	7.7	7.7	8.5	8.1	6.1	5.5	4.9	4.9	5.1	5.9
5	6.5	9.0	7.7	7.6	8.4	8.1	6.0	5.5	4.9	4.9	5.0	7.2
6	6.0	8.5	7.5	7.8	8.4	8.2	6.0	5.5	4.9	4.9	5.0	6.4
7	6.0	8.0	7.4	8.0	8.4	7.9	6.0	5.5	4.9	4.9	5.0	6.1
8	6.2	7.9	7.5	8.0	8.3	7.9	6.0	5.4	4.9	4.9	5.0	5.8
9	6.4	7.9	7.5	8.3	8.3	7.8	6.0	5.3	4.9	4.9	5.0	5.8
10	6.8	7.8	7.5	8.4	8.3	7.7	5.9	5.2	4.9	4.9	5.0	5.7
11	6.9	7.8	7.5	8.5	8.3	7.7	5.9	5.0	4.9	4.9	5.0	5.6
12	7.0	7.7	7.5	8.7	8.4	7.6	5.9	5.0	4.9	4.9	4.9	5.5
13	7.2	7.5	7.5	9.0	8.5	7.6	5.9	5.0	4.9	4.9	4.9	5.5
14	10.3	7.4	8.1	9.5	8.5	7.5	5.8	5.0	4.9	4.9	4.9	5.5
15	8.4	7.4	8.6	10.0	8.5	7.5	5.8	5.0	4.9	7.6	4.9	5.3
16	8.0	7.3	8.8	10.5	8.6	7.5	5.8	5.0	4.9	6.6	4.9	5.2
17	7.9	7.2	9.0	10.0	8.7	7.5	5.8	5.0	4.9	5.8	4.9	5.3
18	7.9	7.1	9.4	9.8	8.8	7.5	5.7	5.0	4.9	5.5	4.9	5.2
19	8.5	7.0	9.6	9.5	8.9	7.6	5.7	5.0	4.9	5.3	4.9	5.1
20	10.5	7.0	9.5	9.4	8.9	7.6	5.7	5.0	4.9	5.2	5.1	5.0
21	11.0	7.1	9.0	9.6	9.0	7.6	5.7	5.0	4.9	5.1	6.0	4.9
22	10.0	7.2	9.0	9.8	9.0	7.5	5.7	5.0	4.9	5.1	7.2	5.0
23	9.5	7.2	8.9	10.0	9.0	7.4	5.6	5.0	4.9	5.1	6.9	5.2
24	9.1	7.3	8.9	9.7	9.1	7.4	5.6	5.0	4.9	5.1	6.4	5.5
25	9.0	7.3	8.8	9.5	9.2	7.3	5.6	5.0	4.9	5.1	5.9	5.3
26	8.7	7.5	8.7	9.2	9.0	7.2	5.6	5.0	4.9	5.1	5.6	5.3
27	9.0	7.6	8.6	9.0	8.8	7.0	5.5	5.0	4.9	5.0	5.5	5.3
28	8.6	7.8	8.6	9.0	8.7	6.9	5.5	4.9	4.9	5.0	5.4	5.3
29	8.0	8.0	8.5	9.0	8.5	6.7	5.5	4.9	4.9	5.0	5.4	5.2
30	7.7	.....	8.3	9.1	8.4	6.6	5.5	4.9	4.9	6.0	5.3	5.2
31	7.5	.....	8.1	.....	8.3	.....	5.5	4.9	.....	5.6	.....	5.2

NOTE.—The gage was washed out March 19, 1907, and a new gage installed at same datum April 8, 1907. Gage heights observed on the Geological Survey gage for March 11 to 18 are evidently in error. Gage heights for these periods have been estimated from readings on the Weather Bureau gage on Oroville bridge.

Rating tables for Feather River at Oroville, Cal.

JANUARY 1, 1906, TO MARCH 25, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	3,960	5.70	5,900	7.80	9,080	16.00	42,000
4.10	4,070	5.80	6,020	8.00	9,450	17.00	47,500
4.20	4,180	5.90	6,140	8.20	9,830	18.00	53,500
4.30	4,290	6.00	6,260	8.40	10,220	19.00	59,500
4.40	4,400	6.10	6,390	8.60	10,630	20.00	65,500
4.50	4,510	6.20	6,520	8.80	11,100	21.00	71,700
4.60	4,620	6.30	6,650	9.00	11,600	22.00	78,000
4.70	4,730	6.40	6,780	9.20	12,100	23.00	84,300
4.80	4,840	6.50	6,910	9.40	12,620	24.00	90,600
4.90	4,950	6.60	7,050	9.60	13,160	25.00	96,900
5.00	5,060	6.70	7,190	9.80	13,700	26.00	103,200
5.10	5,180	6.80	7,330	10.00	14,260	27.00	109,500
5.20	5,300	6.90	7,480	11.00	17,600	28.00	115,800
5.30	5,420	7.00	7,640	12.00	21,500	29.00	122,100
4.40	5,540	7.20	8,000	13.00	26,000	30.00	128,400
4.50	5,660	7.40	8,360	14.00	31,000	31.00	134,700
5.60	5,780	7.60	8,720	15.00	36,500		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906 and is well defined below gage height 17 feet. Above gage height 21 feet the curve is a tangent, the difference being 630 per tenth.

MARCH 26 TO DECEMBER 31, 1907.

6.00	1,650	7.40	4,900	8.80	8,940	10.20	13,870
6.10	1,850	7.50	5,160	8.90	9,260	10.30	14,250
6.20	2,060	7.60	5,430	9.00	9,590	10.40	14,630
6.30	2,270	7.70	5,700	9.10	9,920	10.50	15,020
6.40	2,490	7.80	5,970	9.20	10,260	10.60	15,410
6.50	2,710	7.90	6,250	9.30	10,600	10.70	15,800
6.60	2,940	8.00	6,530	9.40	10,950	10.80	16,200
6.70	3,170	8.10	6,820	9.50	11,300	10.90	16,600
6.80	3,410	8.20	7,110	9.60	11,660	11.00	17,000
6.90	3,650	8.30	7,400	9.70	12,020	12.00	21,300
7.00	3,890	8.40	7,700	9.80	12,380	13.00	26,000
7.10	4,140	8.50	8,000	9.90	12,750		
7.20	4,390	8.60	8,310	10.00	13,120		
7.30	4,640	8.70	8,620	10.10	13,490		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is well defined. Above 13 feet it is the same as the 1906 table.

JANUARY 1 TO MAY 31, 1908.

5.50	770	6.90	3,540	8.30	7,160	9.70	11,500
5.60	930	7.00	3,770	8.40	7,440	9.80	11,850
5.70	1,090	7.10	4,010	8.50	7,730	9.90	12,200
5.80	1,270	7.20	4,250	8.60	8,020	10.00	12,560
5.90	1,450	7.30	4,500	8.70	8,310	10.10	12,920
6.00	1,640	7.40	4,750	8.80	8,610	10.20	13,290
6.10	1,830	7.50	5,000	8.90	8,910	10.30	13,660
6.20	2,030	7.60	5,260	9.00	9,210	10.40	14,030
6.30	2,230	7.70	5,520	9.10	9,520	10.50	14,410
6.40	2,440	7.80	5,790	9.20	9,840	10.60	14,790
6.50	2,650	7.90	6,060	9.30	10,160	10.70	15,170
6.60	2,870	8.00	6,330	9.40	10,490	10.80	15,560
6.70	3,090	8.10	6,600	9.50	10,820	10.90	15,950
6.80	3,310	8.20	6,880	9.60	11,160	11.00	16,340

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during October, 1907, to May, 1908, and is well defined.

Rating tables for Feather River at Oroville, Cal.—Continued.

JUNE 1 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	1,150	5.70	2,160	6.60	3,350	7.50	5,110
4.90	1,250	5.80	2,280	6.70	3,510	7.60	5,340
5.00	1,350	5.90	2,400	6.80	3,680	7.70	5,570
5.10	1,460	6.00	2,530	6.90	3,860	7.80	5,810
5.20	1,570	6.10	2,660	7.00	4,050	7.90	6,060
5.30	1,680	6.20	2,790	7.10	4,250	8.00	6,320
5.40	1,800	6.30	2,920	7.20	4,460	8.10	6,590
5.50	1,920	6.40	3,060	7.30	4,670	8.20	6,870
5.60	2,040	6.50	3,200	7.40	4,890		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during the latter part of 1908 and is well defined.

Monthly discharge of Feather River at Oroville, Cal., for 1907 and 1908.

[Drainage area, 3,640 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	12,400	3,960	7,130	1.96	2.26	438,000	B.
February	78,500	7,640	21,500	5.91	6.15	1,190,000	B.
March	187,000	8,540	36,900	10.1	11.64	2,270,000	C.
April	42,000	25,500	29,500	8.10	9.04	1,760,000	B.
May	28,600	17,000	23,400	6.43	7.41	1,440,000	B.
June	26,000	8,940	15,200	4.18	4.66	904,000	B.
July	8,000	4.140	6,000	1.65	1.90	369,000	C.
August	3,890	1,850	2,650	.728	.84	163,000	C.
September	2,710	1,650	1,900	.522	.58	113,000	C.
October	2,710	1,650	1,850	.508	.59	114,000	C.
November	2,490	1,650	1,780	.489	.55	106,000	C.
December	9,920	1,650	6,060	1.66	1.91	373,000	C.
The year	187,000	1,650	12,800	3.52	47.53	9,240,000	
1908.							
January	16,300	1,640	6,610	1.82	2.10	406,000	B.
February	16,300	3,770	6,380	1.75	1.89	367,000	B.
March	11,200	4,750	7,250	1.99	2.29	446,000	B.
April	14,400	5,260	9,210	2.53	2.82	548,000	B.
May	9,840	7,160	8,170	2.24	2.58	502,000	B.
June	6,870	3,350	5,310	1.46	1.63	316,000	B.
July	3,200	1,920	2,320	.637	.73	143,000	B.
August	2,040	1,250	1,510	.415	.48	92,800	C.
September	1,250	1,250	1,250	.343	.38	74,400	C.
October	5,340	1,250	1,650	.453	.52	101,000	C.
November	4,460	1,250	1,750	.481	.54	104,000	C.
December	4,460	1,250	1,910	.525	.61	117,000	C.
The year	16,300	1,250	4,440	1.22	16.57	3,220,000	

HAMILTON BRANCH NEAR PRATTVILLE, CAL.

This station, which was established June 12, 1905, to obtain data for studies of power available on North Fork of Feather River, is about 3 miles east of Prattville and 1¼ miles above the junction with North Fork. The drainage area above the station is 230 square miles.

The channel is straight and has a shale bottom subject to slight change. At low water the measuring section is about 70 feet wide and 4 feet deep.

This station was discontinued July 1, 1907.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of Hamilton Branch near Prattville, Cal., in 1905 and 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 12	R. W. Armstrong	3.08	394	January 19	L. J. Bevan	3.60	567
June 23	W. E. Spear	2.74	243	February 28	do	3.92	745
July 3	do	2.62	215	April 12	do	4.43	1,017
July 28	do	2.56	209	May 15	do	5.21	1,494
August 15	L. J. Bevan	2.56	211	July 7	do	3.19	439
September 4	do	2.55	210	August 8	do	2.77	294
December 17	do	2.40	177				

Daily gage height, in feet, of Hamilton Branch near Prattville, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1						4.33	16		3.60	3.35			
2		5.36	4.75				17						
3							18						
4				4.50	5.38		19	2.65					
5	2.99						20						
6							21						
7							22						
8							23		5.05				
9		4.62	4.64				24						
10							25					4.25	
11					5.42		26	2.69					
12	2.72			5.60			27						
13							28						
14							29						
15							30						
							31						

Rating table for Hamilton Branch near Prattville, Cal., from June 17, 1905, to June 30, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gaga height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	168	3.30	454	4.20	881	5.10	1,423
2.50	194	3.40	493	4.30	936	5.20	1,488
2.60	220	3.50	534	4.40	992	5.30	1,553
2.70	249	3.60	577	4.50	1,050	5.40	1,619
2.80	280	3.70	624	4.60	1,109	5.50	1,685
2.90	312	3.80	672	4.70	1,170	5.60	1,753
3.00	346	3.90	722	4.80	1,232	5.70	1,820
3.10	381	4.00	774	4.90	1,295	5.80	1,888
3.20	417	4.10	827	5.00	1,359	5.90	1,957

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on thirteen discharge measurements made during 1905 and 1906, and is well defined between gage heights 2.4 feet and 5.2 feet.

Monthly discharge of Hamilton Branch near Prattville, Cal., for 1905 to 1907.

[Drainage area, 230 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
June 17–30	315	226	264	1.15	0.60	7,330	A.
July	237	210	219	.952	1.10	13,500	A.
August	217	207	211	.917	1.06	13,000	A.
September	207	194	202	.878	.98	12,000	A.
October	204	189	191	.830	.96	11,700	A.
November	188	176	182	.791	.88	10,800	A.
December	178	168	171	.743	.86	10,500	A.
The period						78,800	
1906.							
January	577	165	333	1.45	1.67	20,500	B.
February	774	417	575	2.50	2.60	31,900	A.
March	1,480	346	757	3.29	3.79	46,500	B.
April	1,360	707	1,030	4.48	5.00	61,300	B.
May	1,850	700	1,290	5.61	6.47	79,300	A.
June	1,110	534	846	3.68	4.11	50,300	A.
July	501	270	347	1.51	1.74	21,300	A.
August	271	240	254	1.10	1.27	15,600	A.
September	246	217	231	1.00	1.12	13,700	A.
October	216	197	212	.922	1.06	13,000	A.
November	226	212	218	.948	1.06	13,000	A.
December	843	217	343	1.49	1.72	21,100	A.
The year	1,850	165	572	2.33	31.61	388,000	
1907.							
January	534	194	288	1.25	1.44	17,700	A.
February	2,500	577	1,220	5.30	5.52	67,800	A.
March	4,100	468	1,340	5.83	6.72	82,400	B.
April	2,500	1,050	1,710	7.43	8.29	102,000	B.
May	1,890	908	1,460	6.35	7.32	89,800	B.
June	1,300	556	877	3.81	4.25	52,200	B.
The period						412,000	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. The daily discharges for days when there were no gage readings were estimated with the aid of a hydrograph, following the rate of rise and fall at the station below Prattville, where daily observations were obtained most of the time. The sum of the monthly means for this station and the one on North Fork above Prattville have been compared with those for the station below Prattville, and the ratios indicate that the values as a whole are good. Gage heights for 1905 and 1906 are given in Water-Supply Paper 213, p. 131.

BUTT CREEK AT BUTTE VALLEY, CAL.

Butt Creek rises in the extreme western part of Plumas County and flows eastward, discharging into North Fork of Feather River about 9 miles south of Prattville. The creek is about 25 miles long, and its drainage area comprises 74 square miles. It has an approximate fall of 3,000 feet, and is well adapted for power development.

The gaging station was established June 14, 1905, about 2 miles above the mouth of the creek and 100 feet below the foot bridge at the lower end of Butte Valley. The bottom of the channel is composed of coarse gravel and is not likely to change materially.

The following data have been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of Butt Creek at Butte Valley, Cal., in 1905 to 1908.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 14	R. W. Armstrong	2.84	76	June 21	L. J. Bevan	3.54	179
July 18	do	2.51	42	July 24	do	2.68	57
August 19	do	2.39	35	August 30	W. V. Hardy	[a] 2.58	42
September 9	W. E. Spear	2.38	30	1907.			
1906.				July 22	L. J. Bevan	2.63	61
March 2	L. J. Bevan	3.16	136	1908.			
March 27	do	4.54	365	August 18	L. J. Bevan	2.18	29.4
April 10	do	4.75	426				

[a] Interpolated between readings of observer.

NOTE.—About 5 second-feet are diverted 6 miles above this station from Butt Creek into Yellow Creek watershed.

Daily gage height, in feet, of Butt Creek at Butte Valley, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.00	4.32	3.70	3.98	4.90	4.11	2.88	2.46	2.39	2.31	2.46	2.29
2	3.02	6.50	3.38	3.98	4.85	4.05	2.85	2.46	2.39	2.31	2.50	2.29
3	2.90	6.18	3.38	3.88	4.78	4.00	2.84	2.45	2.39	2.31	2.49	2.30
4	3.00	5.93	3.38	3.88	5.07	3.92	2.82	2.45	2.41	2.31	2.48	2.30
5	3.01	5.44	3.36	3.88	4.65	3.82	2.80	2.45	2.40	2.31	2.46	2.36
6	3.02	4.71	3.35	3.93	4.50	3.72	2.78	2.45	2.39	2.31	2.44	2.52
7	3.02	4.33	3.34	4.13	4.45	3.70	2.79	2.44	2.38	2.31	2.43	3.28
8	3.01	4.03	3.27	4.33	4.43	3.75	2.77	2.44	2.38	2.31	2.43	3.05
9	3.03	3.80	3.28	4.58	4.50	3.63	2.80	2.43	2.37	2.31	2.44	2.98
10	3.00	3.70	3.38	5.33	4.60	3.42	2.79	2.43	2.36	2.31	2.45	3.05
11	2.90	3.70	3.23	5.38	4.78	4.08	2.76	2.43	2.35	2.32	2.45	3.21
12	2.78	3.62	3.26	5.50	4.75	4.22	2.75	2.43	2.34	2.35	2.45	2.71
13	2.80	3.63	3.12	5.58	4.35	3.79	2.74	2.42	2.34	2.32	2.45	2.79
14	2.85	3.57	3.06	5.73	4.25	3.60	2.72	2.41	2.34	2.33	2.40	2.94
15	3.10	3.51	3.06	5.86	4.32	3.48	2.68	2.40	2.34	2.32	2.38	2.60
16	3.12	3.61	3.13	5.70	4.30	3.35	2.65	2.40	2.34	2.31	2.38	2.55
17	3.08	3.72	4.78	5.48	4.28	3.30	2.63	2.40	2.34	2.31	2.38	2.54
18	3.04	3.68	8.15	5.43	4.28	3.38	2.60	2.39	2.35	2.31	2.34	2.51
19	3.00	3.68	8.50	5.68	4.65	3.22	2.59	2.39	2.35	2.31	2.32	2.52
20	2.96	3.70	7.36	5.68	4.60	3.22	2.57	2.39	2.34	2.31	2.32	2.55
21	2.92	3.80	6.37	5.50	4.24	3.22	2.56	2.39	2.34	2.31	2.32	2.53
22	2.90	3.88	5.91	5.45	4.08	3.35	2.55	2.39	2.33	2.31	2.32	2.52
23	2.84	3.81	4.68	5.60	4.02	3.25	2.56	2.39	2.33	2.32	2.32	2.53
24	2.81	3.93	4.78	5.70	3.97	3.15	2.55	2.39	2.32	2.32	2.32	2.55
25	2.75	4.08	5.04	5.55	3.96	3.10	2.55	2.39	2.32	2.33	2.31	2.52
26	2.75	3.94	4.61	5.45	3.94	3.05	2.54	2.39	2.32	2.35	2.30	3.02
27	2.72	3.61	4.41	5.40	3.91	3.01	2.53	2.39	2.32	2.35	2.30	4.25
28	2.91	3.55	3.97	5.30	3.94	2.95	2.55	2.40	2.32	2.34	2.30	3.90
29	3.11	.....	3.82	5.15	3.95	2.92	2.56	2.40	2.32	2.32	2.30	3.70
30	3.02	.....	3.81	5.00	3.97	2.90	2.52	2.40	2.32	2.41	2.30	3.60
31	3.51	.....	3.82	.....	4.04	.....	2.50	2.40	.....	2.45	.....	3.80
1908.												
1	3.02	2.53	2.71	3.00	3.28	2.95	2.33	2.07	2.10	2.10	2.13	2.13
2	2.90	2.64	2.91	3.00	3.36	2.92	2.31	2.04	2.10	2.10	2.12	2.15
3	2.80	2.83	2.86	3.07	3.26	2.86	2.29	2.01	2.10	2.10	2.11	2.18
4	2.68	2.69	2.82	3.12	3.15	2.84	2.29	2.00	2.09	2.10	2.10	2.30
5	2.70	2.69	2.70	3.21	3.12	2.82	2.28	2.00	2.09	2.10	2.10	2.32
6	2.75	2.68	2.74	3.30	3.12	2.82	2.28	2.00	2.09	2.09	2.10	2.25
7	2.72	2.67	2.75	3.15	3.14	2.82	2.27	2.00	2.12	2.09	2.10	2.20
8	2.70	2.70	2.73	3.12	3.15	2.80	2.26	2.00	2.11	2.10	2.10	2.19
9	2.65	2.66	2.70	3.31	3.12	2.75	2.24	2.10	2.10	2.10	2.10	2.18
10	2.62	2.62	2.65	3.45	3.15	2.74	2.24	2.10	2.16	2.10	2.10	2.17
11	2.61	2.65	2.70	3.62	3.11	2.73	2.23	2.10	2.16	2.10	2.10	2.19
12	2.58	2.58	2.75	3.77	3.16	2.74	2.24	2.10	2.17	2.10	2.10	2.20
13	2.64	2.55	2.80	3.80	3.16	2.71	2.25	2.10	2.18	2.10	2.10	2.21
14	2.91	2.62	2.85	3.72	3.16	2.68	2.21	2.10	2.18	2.15	2.10	2.20
15	2.81	2.58	2.95	3.80	3.36	2.66	2.18	2.10	2.19	2.53	2.10	2.19

Daily gage height, in feet, of Butt Creek at Butte Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	2.73	2.56	3.23	3.75	3.25	2.61	2.17	2.10	2.22	2.29	2.10	2.20
17	2.69	2.55	3.35	3.60	3.12	2.59	2.17	2.10	2.23	2.20	2.10	2.20
18	2.74	2.55	3.45	3.60	3.22	2.57	2.18	2.11	2.22	2.13	2.10	2.20
19	2.74	2.55	3.33	3.58	3.45	2.55	2.18	2.11	2.20	2.13	2.10	2.20
20	2.82	2.55	3.28	3.70	3.22	2.53	2.18	2.11	2.18	2.12	2.20	2.21
21	2.84	2.55	3.25	3.63	3.20	2.63	2.15	2.11	2.10	2.11	2.47	2.20
22	3.05	2.55	3.22	3.55	3.15	2.52	2.15	2.11	2.10	2.11	2.38	2.19
23	2.90	2.59	3.23	3.50	3.11	2.47	2.15	2.11	2.10	2.11	2.48	2.14
24	2.92	2.61	3.32	3.40	3.11	2.43	2.15	2.11	2.10	2.11	2.35	2.14
25	2.80	2.65	3.52	3.40	3.12	2.40	2.14	2.11	2.10	2.10	2.20	2.14
26	2.80	2.70	3.29	3.30	3.12	2.39	2.14	2.11	2.10	2.10	2.14	2.14
27	2.72	2.72	3.23	3.29	3.08	2.37	2.13	2.11	2.10	2.10	2.10	2.14
28	2.68	2.75	3.12	3.27	3.07	2.36	2.13	2.11	2.10	2.10	2.10	2.14
29	2.63	2.80	3.10	3.30	3.07	2.35	2.13	2.10	2.10	2.12	2.10	2.14
30	2.63	.....	3.15	3.33	3.00	2.34	2.11	2.10	2.10	2.27	2.12	2.15
31	2.53	.....	3.03	.....	2.98	.....	2.09	2.10	.....	2.14	.....	2.16

Rating tables for Butt Creek at Butte Valley, Cal.

JUNE 14, 1905, TO JANUARY 18, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	28	3.60	201	4.90	453	6.40	832
2.40	33	3.70	218	5.00	475	8.60	889
2.50	41	3.80	236	5.10	497	6.80	948
2.60	50	3.90	254	5.20	520	7.00	1,010
2.70	61	4.00	272	5.30	544	7.20	1,074
2.80	73	4.10	290	5.40	568	7.40	1,140
2.90	87	4.20	308	5.50	592	7.60	1,206
3.00	101	4.30	326	5.60	617	7.80	1,272
3.10	117	4.40	346	5.70	643	8.00	1,338
3.20	133	4.50	366	5.80	669	8.20	1,404
3.30	150	4.60	387	5.90	695	8.40	1,470
3.40	167	4.70	409	6.00	722	8.60	1,536
3.50	184	4.80	431	6.20	776		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1905–6 and is well defined between gage heights 2.38 feet and 4.8 feet.

JANUARY 19, 1906, TO MARCH 18, 1907.

2.40	28	2.70	57	3.00	100	3.30	150
2.50	36	2.80	70	3.10	116	3.40	167
2.60	46	2.90	84	3.20	133		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1906 and is well defined between gage heights 2.55 feet and 4.8 feet. Above gage height 3.4 feet the rating curve is the same as that for 1905.

MARCH 19, 1907, TO DECEMBER 31, 1908.

2.00	21	2.40	43	2.80	81	3.20	137
2.10	25	2.50	50	2.90	94	3.30	152
2.10	30	2.60	59	3.00	108	3.40	167
2.30	36	2.70	69	3.10	122		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1907–8 and is fairly well defined between gage heights 2.1 feet and 4.8 feet. Above gage height 3.4 feet the rating curve is the same as that for 1905.

Monthly discharge of Butt Creek near Butte Valley, Cal., for 1905 to 1908.

[Drainage area, 73 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
June 14–30	79	61	69.2	0.948	0.60	2,330	B.
July	61	38	47.2	.647	.75	2,900	B.
August	38	32	33.6	.460	.53	2,070	B.
September	32	32	32.0	.438	.49	1,900	B.
October	32	32	32.0	.438	.50	1,970	A.
November	37	32	33.3	.456	.51	1,980	A.
December	71	42	58.8	.805	.93	3,620	A.
The period						16,800	
1906.							
January	1,240	57	221	3.03	3.49	13,600	A.
February	290	55	141	1.93	2.01	7,830	A.
March	722	124	287	3.93	4.53	17,600	A.
April	508	265	360	4.93	5.50	21,400	A.
May	431	211	320	4.38	5.05	19,700	A.
June	350	114	220	3.01	3.36	13,100	A.
July	121	47	69.3	.949	1.09	4,260	A.
August	47	44	45.9	.629	.73	2,820	A.
September	49	42	44.9	.615	.69	2,670	A.
October	62	40	42.6	.584	.67	2,620	A.
November	89	32	48.7	.667	.74	2,900	A.
December	352	30	90.2	1.24	1.43	5,550	A.
The year	1,240	30	158	2.16	29.29	114,000	
1907.							
January	186	60	95.1	1.30	1.50	5,850	A.
February	860	186	312	4.27	4.45	17,300	A.
March	1,500	110	367	5.03	5.80	22,600	A.
April	685	250	500	6.85	7.64	29,800	A.
May	490	256	343	4.70	5.42	21,100	A.
June	312	94	186	2.55	2.84	11,100	A.
July	91	50	67.1	.919	1.06	4,130	A.
August	47	42	43.8	.600	.69	2,690	A.
September	44	37	39.6	.542	.60	2,360	A.
October	46	37	37.9	.519	.60	2,330	A.
November	50	36	41.8	.573	.64	2,490	A.
December	317	35	97.8	1.34	1.54	6,010	A.
The year	1,500	35	178	2.43	32.78	128,000	
1908.							
January	115	57	76.5	1.05	1.21	4,700	A.
February	81	53	62.6	.858	.93	3,600	A.
March	187	64	113	1.55	1.79	6,950	A.
April	236	108	173	2.37	2.64	10,300	A.
May	176	105	132	1.81	2.09	8,120	A.
June	101	39	64.6	.885	.99	3,840	A.
July	38	25	30.4	.416	.48	1,870	A.
August	26	21	24.5	.336	.39	1,510	A.
September	32	25	26.7	.366	.41	1,590	A.
October	53	25	27.1	.371	.43	1,670	A.
November	49	25	28.2	.386	.43	1,680	A.
December	37	26	29.5	.404	.47	1,810	A.
The year	236	21	65.7	.900	12.26	47,600	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. Discharges were interpolated for days on which gage was not read.

INDIAN CREEK NEAR CRESCENT MILLS, CAL.

Indian Creek rises in the Sierra Divide and flows westward to its junction with North Fork of Feather River. The stream is about 50 miles long and its drainage area, comprising 1,025 square miles, is much greater than that of North Fork above the junction of the two streams. The basin is in the northeastern part of Plumas County, north of Middle Fork of Feather River and east of the upper part of North Fork. For about 45 miles it lies along the Sierra Divide, which separates it from Honey Lake drainage basin at the east. The principal tributaries are Squaw, Red, Clover, Little Grizzly, and Spanish creeks from the south and Light and Wolf creeks from the north.

Practically all of the Indian Creek basin has an altitude exceeding 5,000 feet, and much of it is a lava formation 6,000 to 7,000 feet in altitude. The entire basin is included in a national forest reserve, except a few small meadows, of which Indian and American valleys are the largest.

The mean annual precipitation is between 40 and 45 inches, and a large part of it occurs as snowfall. During the winter the streams freeze over occasionally.

The basin affords several good storage reservoir sites. Opportunities for power development are also good. With the available fall, the flow of the streams is sufficient to generate at least 20,000 horsepower continuously, and by utilizing storage 60,000 horsepower could be developed.

The longest run-off record covers only three years, of which 1907 was the wettest and 1908 the driest. The results in these probably represent extreme conditions. The total flow in 1907 was more than three times that in 1908.

The gaging station, which was established November 29, 1905, to determine the quantity of water available for storage, is located about 1¼ miles below Crescent Mills, on the Greenville-Taylorsville road, and about 2,000 feet below the Arlington Bridge.

This station is at the lower end of Indian Valley, above which point nearly all the important tributaries enter. Spanish Creek enters about 5 miles below the station.

The bed of the stream is practically permanent. At low water the stream is deep, and the current is very sluggish. No change has been made in the datum of the gage.

Daily gage height, in feet, of Indian Creek near Crescent Mills, Cal., for 1907 and 1908.

[Eugene Cook, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.6	6.05	5.0	7.65	7.55	5.6	3.2	1.9	1.35	1.5	1.8	1.7
2	3.3	9.15	5.15	8.15	7.45	5.7	3.1	1.8	1.35	1.5	1.8	1.7
3	3.4	10.2	5.15	8.1	7.35	5.7	3.0	1.75	1.4	1.5	1.8	1.7
4	4.3	9.55	5.2	7.75	7.25	5.6	2.9	1.7	1.45	1.55	1.8	1.8
5	4.4	9.3	5.15	7.6	7.0	5.4	2.8	1.7	1.5	1.55	1.75	2.0
6	3.5	8.8	5.45	7.2	6.85	5.2	2.7	1.65	1.5	1.5	1.75	2.5
7	3.25	7.9	5.35	7.4	6.75	5.05	2.65	1.6	1.5	1.5	1.75	3.5
8	3.15	7.0	5.05	7.9	6.65	5.05	2.6	1.55	1.45	1.45	1.75	3.3
9	3.1	6.4	4.9	8.3	6.7	4.8	2.6	1.5	1.45	1.45	1.7	2.8
10	3.05	6.05	5.15	8.85	6.75	4.6	2.5	1.45	1.4	1.45	1.7	3.3
11	2.95	5.8	5.0	9.6	6.9	4.75	2.45	1.45	1.4	1.45	1.7	3.7
12	2.85	5.7	5.0	10.2	7.05	5.4	2.4	1.45	1.35	1.6	1.7	3.1
13	2.8	5.5	4.7	10.25	6.9	5.35	2.3	1.45	1.35	1.75	1.7	3.1
14	2.8	5.3	4.5	10.4	6.6	5.15	2.2	1.45	1.4	1.7	1.7	2.8
15	2.75	5.2	4.4	11.6	6.3	4.85	2.2	1.4	1.4	1.65	1.7	2.6
16	2.75	5.2	4.45	11.5	6.35	4.7	2.15	1.35	1.4	1.6	1.7	2.5
17	2.7	5.3	7.1	10.55	6.4	4.5	2.1	1.3	1.4	1.55	1.75	2.35
18	2.7	5.4	17.0	9.95	6.4	4.3	2.1	1.3	1.4	1.55	1.8	2.25
19	2.65	5.4	[a]19.7	9.7	6.55	4.15	2.0	1.3	1.4	1.6	1.8	2.3
20	2.6	5.3	17.9	9.55	6.8	4.05	2.0	1.3	1.4	1.6	1.75	2.3
21	2.55	5.3	14.7	9.3	6.6	4.0	1.95	1.3	1.45	1.6	1.75	2.3
22	2.5	5.4	10.95	8.9	6.3	4.0	1.9	1.3	1.45	1.6	1.75	2.3
23	2.5	5.45	9.0	8.8	5.95	4.0	1.85	1.3	1.45	1.6	1.8	2.25
24	2.55	5.25	7.8	8.9	5.7	3.95	1.8	1.3	1.45	1.6	1.8	2.25
25	2.75	5.45	7.7	8.85	5.6	3.8	1.8	1.3	1.5	1.65	1.8	2.2
26	3.1	5.8	7.5	8.75	5.5	3.65	1.75	1.3	1.5	1.7	1.8	3.2
27	3.25	5.5	7.3	8.55	5.45	3.55	1.8	1.3	1.5	1.75	1.8	5.2
28	4.5	5.0	7.0	8.35	5.4	3.45	1.95	1.3	1.5	1.75	1.75	4.8
29	4.95	.....	6.85	8.1	5.4	3.4	2.0	1.3	1.5	1.8	1.75	3.8
30	4.75	.....	6.75	7.8	5.5	3.3	2.1	1.3	1.5	1.8	1.7	3.5
31	5.15	.....	7.15	.....	5.5	.....	2.0	1.35	.....	1.8	.....	3.8
1908.												
1	3.5	2.8	3.4	4.4	3.95	3.4	1.75	.8	.8	1.0	1.4	1.5
2	3.3	2.75	3.35	4.15	4.05	3.35	1.7	.8	.8	1.0	1.4	1.5
3	3.0	2.9	3.35	4.05	4.05	3.3	1.5	.8	.8	.95	1.35	1.7
4	3.1	3.1	3.3	4.3	3.9	3.25	1.45	.8	.8	.95	1.35	1.9
5	2.9	3.0	3.2	4.55	3.7	3.15	1.45	.8	.8	1.0	1.3	2.35
6	2.65	3.0	3.15	4.8	3.6	3.05	1.45	.8	.8	1.0	1.3	2.1
7	2.55	3.1	3.05	4.9	3.65	3.0	1.6	.8	.8	1.0	1.3	1.9
8	2.65	3.25	3.0	4.45	3.7	2.95	1.55	.8	.8	1.0	1.3	1.8
9	3.0	3.35	3.0	4.35	3.7	2.9	1.5	.75	.8	1.0	1.3	1.8
10	2.85	3.3	3.05	4.7	3.6	2.8	1.45	.75	.8	1.0	1.3	1.7
11	2.75	3.15	3.25	4.9	3.65	2.8	1.45	.75	.8	1.0	1.3	1.65
12	2.7	3.0	3.45	5.2	3.85	2.7	1.45	.75	.8	1.0	1.3	1.6
13	2.9	2.8	3.8	5.4	3.95	2.7	1.4	.75	.8	1.0	1.3	1.6
14	3.3	2.7	4.2	5.5	3.95	2.8	1.4	.75	.8	1.0	1.3	1.6
15	3.5	2.7	4.7	5.45	4.0	2.9	1.4	.75	.8	1.2	1.3	1.6
16	3.4	2.7	5.3	5.45	4.1	2.8	1.4	.8	.85	1.6	1.3	1.55
17	3.25	2.65	5.7	5.3	3.9	2.6	1.4	.8	.9	1.55	1.3	1.5
18	3.35	2.65	6.0	5.0	3.8	2.45	1.35	.8	.95	1.45	1.3	1.45
19	3.4	2.6	6.2	4.85	4.2	2.35	1.35	.8	.95	1.4	1.3	1.45
20	3.65	2.55	5.8	4.9	4.5	2.35	1.3	.8	.95	1.35	1.5	1.45
21	3.95	2.5	5.55	5.0	4.35	2.35	1.25	.8	.95	1.3	1.7	1.45
22	4.25	2.5	5.5	4.95	4.2	2.2	1.2	.8	.95	1.3	1.9	1.5
23	4.15	2.5	5.3	4.7	4.1	2.25	1.15	.8	.95	1.3	2.1	1.55
24	4.05	2.5	5.3	4.5	4.0	2.15	1.05	.8	.95	1.3	1.95	1.6
25	3.9	2.6	5.5	4.35	3.9	1.95	.95	.8	.95	1.3	1.8	1.6
26	3.7	2.7	5.75	4.2	3.85	1.9	.9	.8	.95	1.3	1.7	1.65
27	3.5	2.9	5.3	4.1	3.7	1.85	.9	.8	.95	1.3	1.6	1.7
28	3.3	3.25	5.05	4.0	3.65	1.8	.85	.8	.95	1.3	1.5	1.7
29	3.1	3.5	4.7	4.0	3.6	1.8	.85	.8	.95	1.3	1.5	1.7
30	3.0	.....	4.6	3.9	3.55	1.75	.85	.8	1.0	1.4	1.5	1.65
31	2.9	.....	4.7	.....	3.5	.....	.85	.8	.....	1.45	.....	1.65

[a] Maximum gage height, 20.2 feet.

Rating table for Indian Creek near Crescent Mills, Cal., for 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	16	2.10	200	3.40	502	5.40	1,420
.90	25	2.20	219	3.50	530	5.60	1,540
1.00	35	2.30	238	3.60	560	5.80	1,660
1.10	46	2.40	258	3.70	595	6.00	1,800
1.20	58	2.50	278	3.80	630	6.20	1,940
1.30	71	2.60	299	3.90	665	6.40	2,080
1.40	84	2.70	321	4.00	700	6.60	2,220
1.50	98	2.80	345	4.20	785	6.80	2,360
1.60	113	2.90	369	4.40	880	7.00	2,500
1.70	129	3.00	395	4.60	980	8.00	3,200
1.80	146	3.10	421	4.80	1,080	9.00	3,900
1.90	164	3.20	448	5.00	1,180	10.00	4,600
2.00	182	3.30	475	5.20	1,300	11.00	5,300

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 14 discharge measurements made during 1905 and 1906 and is well defined below gage heights 6.2 feet. Above 7 feet the rating curve is a tangent, the difference being 70 per tenth.

Monthly discharge of Indian Creek near Crescent Mills, Cal., for 1907 and 1908.

[Drainage area, 740 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,270	278	504	0.681	0.79	31,000	A.
February	8,280	1,180	2,210	2.99	3.11	123,000	A.
March	11,400	880	2,930	3.96	4.56	180,000	B.
April	5,720	2,640	3,860	5.22	5.82	230,000	B.
May	2,880	1,420	2,110	2.85	3.29	130,000	A.
June	1,600	475	1,000	1.35	1.51	59,500	A.
July	448	137	241	.326	.38	14,800	A.
August	164	71	91.3	.123	.14	5,610	A.
September	98	77	88.9	.120	.13	5,290	A.
October	146	91	114	.154	.18	7,010	A.
November	146	129	139	.188	.21	8,270	A.
December	1,300	129	384	.519	.60	23,600	A.
The year	11,400	71	1,140	1.54	20.72	818,000	
1908.							
January	808	288	478	.646	.74	29,400	A.
February	530	278	363	.49	.53	20,900	A.
March	1,940	395	989	1.34	1.54	60,800	A.
April	1,480	665	1,030	1.39	1.55	61,300	A.
May	930	530	661	.893	1.03	40,600	A.
June	502	137	306	.414	.46	18,200	A.
July	137	20	72.4	.098	.11	4,450	A.
August	16	12	15.1	.02	.02	928	A.
September	35	16	22.7	.031	.03	1,350	A.
October	113	30	58.8	.08	.09	3,620	A.
November	200	71	94.4	.128	.14	5,620	A.
December	248	91	124	.168	.19	7,620	A.
The year	1,940	12	351	.476	6.43	255,000	

NOTE.—It has been assumed that channel conditions at this station are permanent, and the accuracy rated accordingly.

YUBA RIVER DRAINAGE BASIN.

DESCRIPTION.

Yuba River rises near the crest on the western slope of the high Sierra and flows southwestward to its junction with Feather River at Marysville. The total length of the stream is about 90 miles.

Its basin lies south of the Middle Fork of Feather River basin, west of the Truckee River basin and north of the American and Bear River basins, is chiefly in Yuba, Sierra, and Nevada counties, and is one of the principal subdivisions of the Feather River basin. It has an area of more than 1,300 square miles and is triangular in shape, the base of the triangle lying along the crest of the Sierra. Its extreme length from the mouth of the Yuba River to the crest of the Sierra is about 70 miles, and its greatest width is about 35 miles. The most important tributaries are Middle Fork of Yuba, South Fork of Yuba, and Deer Creek from the south, and North Fork of North Fork and Canyon Creek from the north.

The Yuba basin has a rugged and mountainous topography. From the edge of the Sacramento Valley it rises gently through the foothills and then more abruptly through rounded and broken mountains to the crest of the Sierra, which along the Yuba-Truckee divide has a mean elevation of about 8,000 feet and a few peaks exceeding 9,000 feet. The streams have cut deep canyons which head well up in the mountains. The lower western part of the basin is composed of slates and kindred rocks, much eroded; and the higher eastern part consists of granites and lavas. A stratum of serpentine traverses the basin parallel to the crest but at a considerable distance from it.

The soil is deep in most places and supports a hardy growth of brush and timber, especially along the sides of the canyons. The North Fork basin has at present the best forest cover, and that of South Fork the poorest, but this difference is the result of lumbering operations. All the upper part of the Yuba basin, more than 800 square miles, is now included in a national forest.

The mean annual precipitation ranges from 18 inches at Marysville to about 70 inches near the mountain crest. In the upper and central parts of the basin the precipitation ranges from 50 to 70 inches and occurs principally as snow, which remains on the ground all winter and well into the summer. The North and South Fork basins probably receive the greatest precipitation.

Irrigation development is almost entirely wanting in the Yuba River basin, but the main stream could be used, undoubtedly, for irrigating a part of the Sacramento Valley.

Storage sites in the Yuba River basin are not numerous, though considerable storage is feasible, particularly along the upper part of South Fork. Numerous small lakes near the headwaters of the South Fork are utilized as storage reservoirs. The stored water was originally used in hydraulic mining. At present this water is used for irrigation along the foothill fruit belt in the vicinity of Auburn and also for power development. The minimum flow of the streams is sufficient to develop about 125,000 horsepower without storage.

Perennial springs are found in different parts of Yuba River basin, particularly along the North Fork. In the South Fork basin at the higher elevations are many small glacial lakes, and here also are many rounded, denuded summits and glacial valleys.

The channel of Yuba River for many miles above its mouth has been filled with enormous quantities of mining débris—tailings from hydraulic mining between 1849 and 1880—variously estimated at between 71,000,000 and 700,000,000 cubic yards. The depth of this débris is about 7 feet at the mouth, about 26 feet at Dugnens Point, 11 miles above the mouth, and about 84 feet in The Narrows, 18 miles above the mouth. An attempt has been made to restrain this débris from moving downstream by building barrier dams, but it has not been successful.

The longest run-off record in the Yuba River basin dates from 1903. The wettest year since that time was 1907 and the driest 1908. The total flow in the wettest year was nearly three times that in the driest.

The only gaging station that has been maintained in the basin is on Yuba River near Smartsville, 1903 to 1908.

YUBA RIVER NEAR SMARTSVILLE, CAL.

This station, which is located 1 mile north of Smartsville at a point in the foothills called The Narrows, was established June 2, 1903, to obtain general statistical data regarding the flow of the river. The data are very valuable in connection with flood and reclamation problems of Sacramento Valley.

Deer Creek enters from the east about 1 mile above the station. Its drainage area is 88 square miles. South Fork of Yuba (draining 355 square miles) and North Fork of Yuba (draining 220 square miles) enter from the east about 8 and 15 miles, respectively, above the station. Dry Creek enters from the north about 7 miles below the station. Its drainage area is about 100 square miles.

No diversions are made immediately above the station. Extensive water rights have been acquired throughout this basin and practically the entire flow of the South Fork has been preempted by filings.

At the point of measurement the channel is straight for several hundred feet and is filled to a great depth with gravel and sand—tailings from hydraulic mining. The banks are high and rocky and not subject to overflow, and the current is swift at all stages. The bed of the stream is continually shifting, alternately filling and scouring, so that frequent discharge measurements are necessary. During recent years the bed has been lowering, and on August 1, 1906, the gage datum was lowered 10 feet.

Conditions for obtaining accurate discharge data are poor, owing to the shifting of the bed and the torrential nature of the stream. At high stages only float velocities can be taken.

Discharge measurements of Yuba River near Smartsville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 22	J. R. McKeel	160	570	10.10	2,030
February 5	do	260	2,450	17.50	21,100
February 8	R. S. Hawley	252	1,720	15.40	10,800
February 11	J. R. McKeel	245	1,310	14.65	8,180
February 16	do	245	1,090	14.20	6,370
February 27	do	245	1,080	14.50	6,340
March 7	do	245	1,160	14.60	6,750
March 12	do	245	1,130	14.40	6,320
March 14	do	245	986	14.00	5,000
March 22	do	280	2,050	15.85	13,700
April 4	Hawley and Steward	283	1,470	13.80	9,520
April 8	J. R. McKeel	285	1,460	14.00	9,550
April 23	do	285	1,710	15.00	14,500
April 27	do	285	1,630	14.80	11,900
May 3	W. G. Steward	285	1,430	14.30	8,460
May 8	J. R. McKeel	280	1,390	13.80	7,330
May 16	do	290	1,650	14.20	8,940
May 20	do	290	1,840	14.95	10,900
May 26	do	284	1,520	14.10	8,630
May 29	do	288	1,670	14.65	10,500
June 6	do	285	1,490	14.25	8,950
June 14	do	145	1,080	13.0	5,440
June 20	do	150	1,100	13.05	6,260
June 26	W. F. Martin	145	989	12.80	5,990
July 7	J. R. McKeel	138	841	11.50	4,180
July 13	do	135	766	11.05	3,640
July 21	do	134	608	10.00	2,100
July 28	do	133	520	9.35	1,430
August 11	do	130	424	8.7	711
September 1	do	130	379	8.4	583
October 20	do	130	360	8.20	468
October 22	W. A. Lamb	120	354	8.22	427
November 3	J. R. McKeel	130	372	8.30	531
November 16	do	130	348	8.10	427
November 26	do	130	362	8.20	476
December 2	do	130	352	8.10	437
December 11	do	135	688	10.50	2,790
December 23	do	130	458	8.70	881
1908.					
January 3	J. R. McKeel	135	647	9.80	2,370
January 7	do	135	577	9.40	1,670
January 16	do	140	686	10.20	2,760
January 21	W. A. Lamb	160	1,170	13.10	8,440
January 27	J. R. McKeel	140	760	10.50	3,220
February 3	do	140	834	11.40	4,050
February 11	do	138	656	10.00	2,620
February 18	do	137	562	9.50	1,680
February 24	do	137	546	9.20	1,570
March 9	do	135	633	9.80	2,420
March 14	do	140	762	10.80	3,580
March 18	do	140	890	11.80	5,100
March 23	do	140	811	10.90	4,180
April 7	W. A. Lamb	140	738	10.50	3,130
April 18	do	145	1,000	11.75	5,300
April 20	do	160	1,220	12.90	8,410
May 17	J. R. McKeel	140	872	11.40	4,490
May 24	do	140	1,000	12.05	6,100
June 7	do	140	837	10.90	4,530
June 14	do	140	814	10.50	4,320
June 21	do	140	768	10.20	3,870
August 9	do	125	320	6.80	363
August 23	do	125	315	6.90	328
September 6	do	125	297	6.80	286
September 13	do	125	299	6.80	293
September 20	do	125	302	6.85	303
November 1	do	130	337	7.30	463
December 6	do	130	537	8.40	1,520
December 15	do	130	398	7.20	651
December 20	do	130	378	7.00	567

Daily gage height, in feet, of Yuba River near Smartsville, Cal., for 1907 and 1908.

[J. R. McKeel, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	11.8	21.0	15.3	13.8	14.4	14.6	12.6	9.2	8.4	8.2	8.4	8.1
2	11.3	27.0	14.6	14.4	.....	15.1	12.2	9.2	.....	8.2	8.4	8.1
3	11.3	20.5	14.3	14.0	14.3	14.3	12.4	9.1	8.4	8.2	8.3	8.1
4	14.5	19.5	14.3	13.7	14.2	14.3	.....	9.0	8.4	8.3	8.3	8.1
5	12.4	17.5	14.7	13.9	14.0	14.2	12.0	8.9	8.3	8.3	8.2	8.2
6	11.8	16.8	15.0	14.0	13.9	14.3	11.8	8.9	.....	.....	8.2	8.7
7	11.2	16.0	14.6	14.0	13.8	14.1	11.5	8.8	8.3	8.2	8.3	12.1
8	11.3	15.5	14.4	14.0	13.8	.....	11.4	8.8	.....	8.2	8.3	10.3
9	11.2	15.1	15.6	14.3	14.0	13.6	11.3	8.7	.....	8.3	8.3	9.4
10	10.9	14.9	14.8	14.7	14.1	13.2	11.2	.....	8.3	.....	8.3	9.0
11	10.6	14.7	15.2	15.0	14.3	15.0	11.2	8.7	8.3	.....	.....	10.5
12	10.5	14.5	14.4	15.4	14.0	14.0	11.2	8.7	8.2	8.3	8.2	9.6
13	10.5	14.3	14.1	15.7	13.8	.....	11.0	8.6	.....	.....	8.2	10.0
14	10.7	14.2	14.0	16.2	13.8	13.0	10.9	8.6	.....	8.3	8.2	9.7
15	10.6	14.1	14.0	16.4	14.1	12.6	10.7	.....	8.2	8.3	8.2	9.4
16	10.5	14.2	14.3	15.5	14.2	12.3	10.6	8.5	8.2	8.2	8.1	9.1
17	10.4	14.3	24.0	15.1	14.7	12.4	10.5	8.5	.....	8.2	8.2	8.9
18	10.3	14.4	27.9	15.2	15.0	12.7	10.5	.....	8.2	8.2	8.2	8.8
19	10.2	14.2	29.2	15.4	15.3	13.1	10.4	8.5	8.3	8.2	.....	8.8
20	10.1	14.2	24.0	15.3	15.0	13.1	10.3	8.5	8.2	8.2	8.1	8.7
21	10.1	14.2	18.5	15.2	14.7	13.7	10.0	8.5	.....	8.2	8.2	8.7
22	10.1	14.8	15.9	15.1	14.4	13.0	9.9	8.4	8.2	8.2	.....	.....
23	10.3	.....	16.4	15.0	13.7	12.3	9.8	8.4	8.2	.....	8.2	8.7
24	10.4	14.4	15.0	15.0	14.3	12.4	9.7	.....	.....	8.2	8.2	8.7
25	11.3	15.6	14.5	15.0	.....	12.6	9.6	.....	8.2	8.3	8.2	8.7
26	12.1	15.0	14.1	14.9	14.1	12.6	9.6	8.4	8.3	8.4	8.2	11.5
27	11.7	14.5	13.8	14.8	14.2	12.7	9.5	.....	8.3	8.6	8.0	10.6
28	16.8	14.2	13.6	14.7	14.2	12.6	9.4	8.4	8.3	8.6	7.8	10.0
29	15.0	.....	13.4	14.6	14.7	12.5	9.3	.....	.....	8.5	8.0	10.3
30	13.5	.....	13.2	14.5	14.5	.....	9.3	8.4	8.3	8.4	.....	10.4
31	19.0	.....	13.4	.....	14.5	.....	9.2	8.4	.....	8.4	.....	11.4
1908.												
1	10.1	10.1	10.3	10.0	12.3	11.2	8.2	7.0	.....	6.8	7.3	7.1
2	10.1	10.5	10.9	10.1	12.7	10.8	8.2	.....	6.9	.....	7.3	7.1
3	9.8	11.4	10.7	10.3	12.0	10.0	8.1	6.9	.....	6.8	7.2	7.5
4	10.1	10.5	10.2	10.6	11.0	9.9	8.0	6.9	6.8	.....	7.2	8.3
5	9.7	10.4	10.2	.....	11.1	10.2	.....	6.9	.....	6.8	7.1	9.8
6	9.5	10.4	10.0	10.8	11.3	10.5	7.9	6.9	6.8	.....	.....	8.4
7	9.4	10.2	9.9	10.5	12.2	10.9	7.8	6.9	.....	6.8	7.0	7.9
8	9.4	10.1	.....	10.2	.....	10.8	7.8	6.8	.....	.....	.....	7.7
9	9.5	10.4	9.8	10.5	10.9	10.8	7.7	.....	6.8	6.8	7.0	7.8
10	9.4	10.2	10.0	11.0	10.8	10.7	7.7	6.8	.....	.....	.....	7.5
11	9.4	10.0	10.1	11.6	10.7	10.6	7.6	6.9	6.8	6.8	7.0	7.4
12	9.6	9.9	10.3	11.9	10.8	10.6	.....	6.9	.....	.....	.....	7.3
13	9.9	9.8	10.5	12.3	10.7	10.5	7.5	6.9	6.8	.....	7.0	7.3
14	12.1	9.8	10.8	12.0	11.0	10.4	7.5	.....	.....	6.8	.....	7.3
15	10.8	9.7	11.1	11.6	11.5	10.0	7.5	6.9	6.8	10.2	7.1	7.2
16	10.4	9.6	11.5	11.3	11.2	9.9	7.4	.....	6.9	8.4	7.1	7.1
17	10.2	9.6	11.6	11.2	11.4	9.7	7.4	6.9	6.9	7.8	.....	7.1
18	10.1	9.5	11.8	11.6	12.0	9.5	7.3	.....	.....	7.4	7.1	7.0
19	10.4	9.5	11.6	12.2	13.0	9.4	.....	6.9	6.9	7.4	.....	7.0
20	12.2	9.4	11.3	12.9	12.0	9.3	7.2	.....	6.9	7.3	7.1	7.0
21	13.0	9.4	.....	12.6	11.9	10.2	7.2	6.9	.....	7.3	7.7	7.0
22	12.9	9.3	11.0	12.2	11.8	9.2	7.2	.....	.....	7.2	8.3	7.2
23	11.8	.....	10.9	11.7	11.8	9.0	7.1	6.9	6.8	7.2	8.6	7.1
24	12.1	9.2	10.8	11.4	12.1	8.9	7.1	.....	6.8	7.2	8.0	7.6
25	11.3	9.3	10.9	11.3	12.2	8.8	7.1	6.9	6.8	.....	7.6	7.3
26	10.8	9.5	11.0	11.6	12.0	8.7	.....	.....	.....	7.1	7.3	7.2
27	10.5	9.4	10.8	11.7	11.7	8.6	7.1	.....	6.8	.....	.....	.....
28	10.3	9.6	10.5	12.0	11.8	8.5	7.1	6.9	6.8	7.1	7.1	.....
29	10.2	10.0	.....	12.0	11.7	8.4	7.0	.....	.....	.....	.....	7.1
30	10.0	.....	10.4	12.0	11.6	8.3	7.0	6.9	.....	7.3	7.0	7.1
31	9.8	.....	10.3	.....	.....	.....	7.0	.....	.....	7.4	.....	7.1

Daily discharge, in second-feet, of Yuba River near Smartsville, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4,100	41,000	8,100	9,200	9,200	8,800	5,730	1,220	570	470	570	430
2	3,500	78,000	6,700	11,200	a9,200	10,700	5,130	1,220	a 570	470	570	430
3	3,500	38,400	6,200	10,000	8 500	8,700	5,430	1,120	570	470	520	430
4	8,900	32,400	6,200	9,500	8,200	8,800	a5,130	1,030	570	520	520	430
5	4,900	21,000	6,900	9,800	7,700	8,700	4,830	940	520	520	470	470
6	4,100	17,300	7,500	10,000	7,500	9,100	4,550	940	a 520	a 520	470	770
7	3,400	13,200	6,800	9,800	7,300	8,600	4,130	850	520	470	520	4,980
8	3,500	11,400	6,500	9,600	7,300	a7,800	3,990	850	a 520	470	520	2,490
9	3,400	9,700	9,000	10,600	7,700	7,100	3,850	770	a 520	520	520	1,430
10	3,100	9,000	7,200	12,000	7,900	6,200	3,710	a 770	520	a 520	520	1,030
11	2,800	8,200	8,100	13,500	8,600	10,400	3,710	770	520	a520	a 470	2,750
12	2,700	7,800	6,300	15,100	8,000	7,800	3,710	770	470	520	470	1,650
13	2,700	7,000	5,500	16,500	7,600	a6,300	3,430	700	a 470	a 520	470	2,110
14	2,900	6,800	5,000	19,000	7,800	5,400	3,290	700	a 470	520	470	1,760
15	2,800	6,400	6,000	20,700	8,700	4,900	3,010	a 700	470	520	470	1,430
16	2,700	6,400	6,600	16,000	8,900	4,700	2,880	630	470	470	430	1,120
17	2,600	6,500	56,000	14,400	10,300	4,500	2,750	630	a 470	470	470	940
18	2,500	6,600	85,000	15,000	11,400	4,700	2,750	a 630	470	470	470	850
19	2,400	6,200	100,000	16,000	12,300	5,100	2,620	630	520	470	a 430	850
20	2,300	6,200	60,000	15,600	11,400	6,000	2,490	630	470	470	430	770
21	2,300	6,100	27,000	15,400	10,300	6,000	2,110	630	a 470	470	470	770
22	2,300	7,200	14,000	15,000	9,400	7,300	1,990	570	470	470	a 470	a 770
23	2,500	a6,700	16,500	14,500	7,700	5,800	1,870	570	470	a 470	470	770
24	2,600	6,300	11,000	14,500	9,200	5,300	1,760	a 570	a 470	470	470	770
25	3,500	8,900	9,900	14,500	a8,900	5,500	1,650	a 570	470	520	470	770
26	4,500	7,500	8,900	13,300	8,600	5,700	1,650	570	520	570	470	4,130
27	4,000	6,300	8,400	12,000	8,500	5,700	1,540	a 570	520	700	400	2,880
28	17,700	6,000	8,000	11,300	7,800	5,800	1,430	570	520	700	350	2,110
29	10,400	.....	7,700	10,600	8,500	5,700	1,320	a 570	a 520	630	400	2,490
30	6,700	.....	7,500	9,800	8,400	5,500	1,320	570	520	570	a 400	2,620
31	29,400	.....	8,000	.....	8,600	.....	1,220	570	.....	570	.....	3,990
1908.												
1	2,650	2,300	3,000	2,600	6,720	4,800	1,280	400	a 350	320	470	400
2	2,650	2,700	3,900	2,700	7,800	4,100	1,280	a 400	350	a 320	470	400
3	2,370	4,050	3,600	3,000	5,950	2,900	1,180	350	a 350	320	430	560
4	2,650	2,700	2,900	3,400	4,070	2,780	1,100	350	320	a 320	430	1,000
5	2,100	2,690	2,900	a 3,500	4,200	3,270	a1,100	350	a 320	320	400	2,500
6	1,830	2,720	2,600	3,600	4,600	3,780	1,000	350	320	a 320	a 400	1,530
7	1,670	2,590	2,500	3,130	6,350	4,530	920	350	a 320	320	370	1,100
8	1,700	2,500	a 2,400	2,700	a4,810	4,400	920	320	a 320	a 320	a 370	940
9	1,830	3,000	2,420	3,100	3,500	4,500	840	a 320	320	320	370	1,010
10	1,700	2,800	2,630	3,900	3,470	4,400	840	320	a 320	a 320	a 370	810
11	1,700	2,620	2,750	5,000	3,320	4,300	760	350	320	320	370	750
12	1,960	2,440	2,980	5,600	3,500	4,350	a 760	350	a 320	a 320	a 370	700
13	2,370	2,240	3,150	6,400	3,320	4,250	700	350	320	a 320	370	700
14	6,240	2,200	3,580	5,800	3,800	4,140	700	a 350	a 320	320	a 370	700
15	3,720	2,020	4,020	5,000	4,720	3,600	700	350	320	3,500	400	640
16	3,080	1,860	4,680	4,400	4,200	3,430	630	a 350	350	1,100	400	600
17	2,800	1,810	4,800	4,250	4,490	3,140	630	350	350	700	a 400	600
18	2,650	1,680	5,100	5,000	5,950	2,870	560	a 350	a 350	520	400	550
19	3,090	1,670	4,870	6,500	8,000	2,720	a 560	350	350	520	a 400	550
20	6,460	1,620	4,500	8,410	5,700	2,600	500	a 350	350	480	400	550
21	8,210	1,680	a 4,470	7,550	5,500	3,880	500	350	a 350	480	650	550
22	8,000	1,620	4,250	6,450	5,500	2,450	500	a 350	a 320	440	1,000	650
23	5,610	a1,520	4,180	5,200	5,500	2,200	450	350	320	440	1,220	600
24	6,250	1,570	4,030	4,500	6,200	2,080	450	a 350	320	440	820	880
25	4,630	1,700	4,180	4,300	6,400	1,940	450	350	320	a 440	600	700
26	3,720	1,900	4,250	4,960	6,100	1,820	a 450	a 350	a 320	400	480	650
27	3,220	1,800	3,900	5,200	5,580	1,700	450	a 350	320	a 400	a 440	a 650
28	2,820	2,060	3,400	5,940	5,800	1,580	450	350	320	400	400	a 600
29	2,640	2,530	a 3,250	a 5,940	5,580	1,490	400	a 350	a 320	a 430	a 400	600
30	2,300	.....	3,170	5,940	5,500	1,380	400	350	a 320	470	370	600
31	2,010	.....	3,000	.....	a5,100	.....	400	a 350	.....	520	.....	600

a Estimated.

NOTE.—The daily discharges from January 1 to June 30, 1907, were obtained by the indirect method for shifting channels; for the rest of the year a rating table was used.

Daily discharges for 1908 were computed by the indirect method for shifting channels.

Monthly discharge of Yuba River near Smartsville, Cal., for 1907 and 1908.

[Drainage area, 1,220 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	29,400	2,300	4,990	4.09	4.72	307,000	B.
February	78,000	6,000	14,100	11.6	12.08	783,000	B.
March	100,000	5,000	17,300	14.2	16.37	1,060,000	B.
April	20,700	9,200	13,100	10.7	11.94	780,000	B.
May	12,300	7,300	8,750	7.17	8.27	538,000	B.
June	10,700	4,500	6,750	5.53	6.17	402,000	B.
July	5,730	1,220	3,060	2.51	2.89	188,000	B.
August	1,220	570	736	.603	.70	45,300	B.
September	570	470	505	.414	.46	30,000	B.
October	700	470	517	.424	.49	31,800	B.
November	570	350	472	.387	.43	28,100	B.
December	4,980	430	1,590	1.30	1.50	97,800	B.
The year	100,000	350	5,990	4.91	66.00	4,290,000	
1908.							
January	8,210	1,670	3,380	2.77	3.19	208,000	C.
February	4,050	1,520	2,230	1.83	1.97	128,000	C.
March	5,100	2,400	3,590	2.94	3.39	221,000	C.
April	8,410	2,600	4,800	3.93	4.38	286,000	C.
May	8,900	3,320	5,200	4.26	4.91	320,000	C.
June	4,800	1,380	3,180	2.61	2.91	189,000	C.
July	1,280	400	705	.578	.67	43,300	C.
August	400	320	350	.287	.33	21,500	C.
September	350	320	329	.270	.30	19,600	C.
October	3,500	320	521	.427	.49	32,000	C.
November	1,000	370	478	.392	.44	28,400	C.
December	2,500	400	764	.626	.72	47,000	C.
The year	8,410	320	2,130	1.74	23.70	1,540,000	

BEAR RIVER DRAINAGE BASIN.

DESCRIPTION.

Bear River drains a narrow strip on the western slope of the Sierra below the 5,500-foot contour. The basin is about 60 miles long and not more than 10 miles wide, and lies south of Yuba River basin and north of American River basin. Its total area is less than 300 square miles.

The river rises in the extreme northeastern part of the basin near Emigrant Gap, and flows southwestward to its junction with Feather River about 15 miles south of Marysville. It is the boundary line between Nevada and Placer counties, and closely parallels the Bear-American divide, which is from 1 to 2 miles south of it. Its principal tributaries are Steep Hollow Creek, Greenhorn River, and Wolf Creek, all from the north.

The Bear River basin has very little forest cover, except on a small area in the upper part. The mean annual precipitation ranges from 21 inches in the valley to 52 inches at the source of the river, where much of it occurs as snow that soon disappears.

Very little, if any, irrigation is practiced in this basin.

Storage is not feasible, and the minimum flow of the streams is not sufficient to develop much power.

The longest run-off record extends back to 1904. The wettest year since that time was 1906, and the driest, 1908. The total flow in the wettest year was nearly five times that in the driest.

Only one gaging station has been maintained in this basin, that on Bear River at Van Trent (above Wheatland), 1904 to 1908.

BEAR RIVER AT VAN TRENT, CAL.[a]

This station, which is located about 800 feet below the bridge near the Dairy Farm mine, Van Trent post-office, and 8 miles above Wheatland, was established October 8, 1904, to obtain data regarding the flow of a deforested basin.

No important tributaries enter near the station. Wolf Creek enters from the north about 20 miles above, and has a drainage area of 76 square miles. Rock Creek is very small and enters about 1 mile below. No diversions are made immediately above the station.

The channel has a gravelly bed, and the current is swift at all stages. Only float velocities can be taken in flood. The gage datum has remained unchanged during the life of the station.

Conditions for obtaining accurate discharge data are poor, owing to the rough channel and torrential nature of the stream.

Discharge measurements of Bear River at Van Trent, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 7	R. S. Hawley	160	369	6.70	1,930
February 21	do	118	190	4.90	734
April 5	Steward and Hamilton	145	379	5.70	1,700
April 30	F. M. Hamilton	136	163	3.60	621
May 2	W. G. Steward	131	143	3.65	591
May 19	F. M. Hamilton	132	107	3.20	374
May 22	W. G. Steward	92	81	3.05	324
June 6	F. M. Hamilton	88	51	2.75	220
June 27	W. F. Martin	42	35	2.65	185
September 6	W. A. Lamb	47	32	1.80	40
October 21	do	45	28	1.75	35
1908.					
January 23	W. A. Lamb	135	213	4.00	902
April 9	do	49	53	2.70	223
April 18	do	60	62	2.85	315
September 21	W. V. Hardy	15	12	1.65	35
December 16	W. F. Martin	56	71	2.12	123

[a] Referred to in previous reports as "above Wheatland." Van Trent is a new post-office.

Daily gage height, in feet, of Bear River at Van Trent, Cal., for 1907 and 1908.

[Hermann Ernestus, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.4	10.75	6.9	6.4	3.7	3.0	2.6	1.9	1.8	1.8	2.1	2.1
2	5.0	17.75	6.1	6.2	3.6	2.9	2.5	1.9	1.8	1.8	2.2	1.9
3	4.8	10.5	5.5	5.9	3.5	2.8	2.5	1.9	1.7	1.8	2.1	1.9
4	6.15	9.7	5.3	5.6	3.5	2.8	2.6	1.9	1.8	1.8	2.0	1.9
5	6.8	8.2	6.1	6.0	3.5	2.8	2.4	1.8	1.8	1.8	2.2	2.4
6	5.5	7.3	6.5	5.7	3.4	2.8	2.4	1.8	1.8	1.8	2.0	2.4
7	5.2	6.8	5.6	5.5	3.4	2.9	2.4	1.8	1.8	1.7	2.1	4.15
8	5.85	6.5	5.4	5.4	3.4	2.9	2.3	1.8	1.7	1.8	2.0	3.3
9	5.4	6.1	5.8	5.3	3.3	2.9	2.3	1.8	1.7	1.9	2.0	2.7
10	5.3	5.6	6.8	5.3	3.3	2.7	2.3	1.8	1.7	1.8	2.1	2.5
11	5.1	5.4	7.0	5.2	3.3	3.2	2.2	1.7	1.7	1.8	1.9	3.75
12	4.9	5.4	6.3	5.2	3.4	3.4	2.2	1.7	1.7	1.8	2.1	2.9
13	4.9	5.3	5.6	5.1	3.4	3.4	2.2	1.7	1.7	1.8	1.9	3.0
14	5.3	5.3	5.2	5.55	3.2	3.3	2.2	1.7	1.7	1.8	1.9	2.8
15	5.1	5.2	4.9	6.3	3.2	3.1	2.1	1.7	1.8	1.8	1.9	2.7
16	5.0	5.1	4.9	5.1	3.1	3.0	2.2	1.7	1.8	1.8	1.9	2.8
17	5.2	5.3	13.95	4.8	3.1	2.9	2.2	1.7	1.7	1.8	2.0	2.7
18	5.4	5.3	12.75	4.5	3.1	2.9	2.2	1.7	1.7	1.8	1.9	2.6
19	5.1	5.0	17.8	4.4	3.2	2.8	2.1	1.7	1.8	1.9	1.9	2.5
20	4.9	4.9	13.6	4.3	3.2	2.9	2.1	1.7	1.8	1.9	2.0	3.1
21	4.8	4.8	9.6	4.2	3.2	2.8	2.1	1.7	1.8	1.8	2.0	2.7
22	4.9	6.0	8.8	4.2	3.1	3.2	2.1	1.7	1.7	1.8	1.9	2.6
23	4.9	5.4	13.2	4.1	3.1	2.9	2.1	2.0	1.7	1.8	1.9	2.5
24	5.0	5.0	9.7	4.1	3.2	2.8	2.1	1.9	1.7	1.8	1.9	2.4
25	5.7	7.3	9.4	4.0	3.1	2.8	2.1	1.9	1.8	1.9	1.9	2.5
26	6.0	5.9	8.1	3.9	3.1	2.8	2.1	1.9	1.8	2.0	1.9	3.8
27	5.6	5.3	7.3	3.9	3.0	2.7	2.1	1.8	1.8	2.1	2.0	5.15
28	9.5	5.1	6.9	3.8	3.0	2.7	2.0	1.8	1.8	2.1	2.0	3.5
29	7.3	.....	6.5	3.8	3.0	2.6	2.0	1.8	1.9	2.1	1.9	3.2
30	6.1	.....	6.3	3.7	2.9	2.7	2.0	1.8	1.8	2.1	1.9	3.0
31	7.5	.....	6.4	.....	3.0	.....	1.9	1.9	.....	2.2	.....	6.5
1908.												
1	4.5	3.3	4.15	2.8	2.4	2.4	1.8	1.6	1.6	1.6	1.6	1.8
2	3.5	4.1	4.5	2.8	2.95	2.4	1.8	1.6	1.6	1.7	1.6	1.8
3	3.2	5.5	4.05	2.8	2.75	2.4	1.8	1.6	1.6	1.6	1.6	1.8
4	4.1	4.1	3.8	2.8	2.5	2.4	1.8	1.6	1.6	1.6	1.6	2.4
5	3.3	4.1	3.6	2.8	2.5	2.4	1.7	1.6	1.6	1.6	1.6	3.8
6	3.0	3.7	3.7	2.7	2.5	2.4	1.7	1.6	1.6	1.6	1.6	2.8
7	3.0	3.5	3.6	2.8	2.5	2.4	1.7	1.6	1.6	1.6	1.6	2.5
8	2.9	3.4	3.5	2.7	2.6	2.4	1.7	1.6	1.5	1.6	1.6	2.3
9	3.0	3.5	3.4	2.7	2.5	2.4	1.7	1.6	1.6	1.5	1.5	2.3
10	2.9	3.6	3.4	2.7	2.6	2.4	1.8	1.6	1.6	1.5	1.6	2.4
11	2.9	3.4	3.45	2.7	2.75	2.3	1.7	1.6	1.6	1.5	1.6	2.3
12	2.9	3.3	3.45	2.7	2.8	2.3	1.7	1.6	1.6	1.5	1.6	2.2
13	2.9	3.2	3.5	2.9	2.7	2.3	1.7	1.6	1.6	1.4	1.6	2.1
14	4.4	3.2	3.5	2.9	2.7	2.2	1.7	1.6	1.6	1.4	1.6	2.2
15	3.8	3.1	3.5	2.85	3.2	2.2	1.7	1.6	1.6	2.95	1.6	2.2
16	3.4	3.1	3.5	3.0	3.0	2.2	1.7	1.6	1.6	2.4	1.6	2.1
17	3.2	3.0	3.4	3.05	2.8	2.1	1.7	1.6	1.7	2.1	1.6	2.1
18	3.1	2.9	3.4	2.95	2.7	2.1	1.7	1.6	1.7	1.9	1.6	2.1
19	3.3	2.9	3.3	2.8	2.7	2.1	1.7	1.6	1.7	1.8	1.7	2.1
20	5.6	2.9	3.3	2.8	3.1	2.1	1.7	1.6	1.7	1.8	1.7	2.1
21	6.5	2.8	3.3	2.8	2.9	2.4	1.7	1.6	1.6	1.7	1.9	2.1
22	5.1	2.8	3.2	2.8	2.8	2.2	1.7	1.6	1.6	1.7	2.25	2.1
23	4.1	2.8	3.1	2.8	2.7	2.2	1.7	1.6	1.6	1.7	2.4	2.1
24	5.0	2.7	3.0	3.0	2.7	2.2	1.7	1.6	1.6	1.6	2.4	2.2
25	4.4	2.7	3.0	2.8	2.6	2.1	1.7	1.6	1.6	1.6	2.1	2.1
26	3.9	2.8	3.0	2.7	2.6	2.0	1.7	1.6	1.6	1.6	2.0	2.1
27	3.6	2.7	2.9	2.7	2.5	2.0	1.6	1.6	1.7	1.6	1.9	2.0
28	3.4	2.7	2.9	2.6	2.5	1.9	1.6	1.6	1.6	1.6	1.8	2.0
29	3.3	3.7	2.9	2.6	2.5	1.9	1.6	1.6	1.7	1.6	1.9	2.0
30	3.2	.....	2.8	2.5	2.5	1.9	1.6	1.6	1.6	1.7	1.7	2.0
31	3.2	.....	2.9	.....	2.5	.....	1.6	1.6	.....	1.6	.....	2.0

Rating tables for Bear River at Van Trent, Cal.

JANUARY 1 TO MARCH 25, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	530	5.90	1,400	7.30	2,700	11.00	7,800
4.60	585	6.00	1,470	7.40	2,810	12.00	9,750
4.70	640	6.10	1,540	7.50	2,930	13.00	12,000
4.80	700	6.20	1,620	7.60	3,050	14.00	14,500
4.90	760	6.30	1,700	7.70	3,170	15.00	17,200
5.00	820	6.40	1,780	7.80	3,290	16.00	20,100
5.10	880	6.50	1,870	7.90	3,410	17.00	23,200
5.20	940	6.60	1,960	8.00	3,530	18.00	26,500
3.30	1,000	6.70	2,060	8.20	3,770	19.00	29,900
5.40	1,065	6.80	2,160	8.40	4,030	20.00	33,400
5.50	1,130	6.90	2,260	8.60	4,290	21.00	37,000
5.60	1,195	7.00	2,370	8.80	4,550	22.00	40,700
5.70	1,260	7.10	2,480	9.00	-4,830	23.00	44,500
5.80	1,330	7.20	2,590	10.00	6,150		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty-four discharge measurements made during 1904 to 1907, and is well defined between gage heights 4.5 feet and 6.7 feet.

MARCH 26 TO DECEMBER 31, 1907.

1.70	35	2.90	275	4.10	800	5.60	1,700
1.80	40	3.00	310	4.20	850	5.80	1,840
1.90	45	3.10	345	4.30	905	6.00	1,980
2.00	50	3.20	385	4.40	960	6.20	2,125
2.10	60	3.30	435	4.50	1,015	6.40	2,275
2.20	75	3.40	465	4.60	1,070	6.60	2,430
2.30	95	3.50	510	4.70	1,130	6.80	2,590
2.40	120	3.60	555	4.80	1,190	7.00	2,750
2.50	150	3.70	600	4.90	1,250	8.00	3,650
2.60	180	3.80	650	5.00	1,310		
2.70	210	3.90	700	5.20	1,435		
2.80	240	4.00	750	5.40	1,565		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made after March, 1907, and is well defined between gage heights 1.7 feet and 6 feet.

FOR 1908.

1.40	20	2.50	215	3.60	655	4.70	1,195
1.50	25	2.60	250	3.70	700	4.80	1,250
1.60	30	2.70	285	3.80	745	4.90	1,305
1.70	40	2.80	320	3.90	790	5.00	1,360
1.80	55	2.90	360	4.00	840	5.20	1,480
1.90	70	3.00	400	4.10	890	5.40	1,600
2.00	90	3.10	440	4.20	940	5.60	1,725
2.10	110	3.20	480	4.30	990	5.80	1,855
2.20	135	3.30	520	4.40	1,040	6.00	1,990
2.30	160	3.40	565	4.50	1,090	6.20	2,130
2.40	185	3.50	610	4.60	1,140	6.40	2,275

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1908, and is well defined between gage heights 1.5 feet and 4 feet.

Monthly discharge of Bear River at Van Trent, Cal., for 1907 and 1908.

[Drainage area, 263 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	5,480	700	1,300	4.94	5.70	79,900	C.
February	25,700	700	2,810	10.7	11.14	156,000	C.
March	25,800	760	4,450	16.9	19.48	274,000	C.
April	2,280	600	1,300	4.94	5.51	77,400	C.
May	600	275	404	1.54	1.78	24,800	B.
June	465	180	282	1.07	1.19	16,800	B.
July	180	45	84.7	.322	.37	5,210	B.
August	50	35	39.7	.151	.17	2,440	B.
September	45	35	38.0	.144	.16	2,260	B.
October	75	35	44.5	.169	.19	2,740	B.
November	75	45	51.0	.194	.22	3,030	B.
December	2,350	45	363	1.38	1.59	22,300	B.
The year	25,800	35	931	3.54	47.50	667,000	
1908.							
January	2,350	360	731	2.78	3.20	44,900	C.
February	1,660	285	535	2.03	2.19	30,800	C.
March	1,090	320	553	2.10	2.42	34,000	C.
April	420	215	316	1.20	1.34	18,800	C.
May	480	185	280	1.06	1.22	17,200	C.
June	185	70	142	.540	.60	8,450	C.
July	55	30	40.8	.155	.18	2,510	C.
August	30	30	30.0	.114	.13	1,840	C.
September	40	25	31.8	.121	.14	1,890	C.
October	380	20	52.1	.198	.23	3,200	C.
November	185	25	54.2	.206	.23	3,230	C.
December	745	55	145	.551	.64	8,920	C.
The year	2,350	20	243	.921	12.52	176,000	

AMERICAN RIVER DRAINAGE BASIN.

DESCRIPTION.

American River drains the area lying on the western slope of the Sierra, south of the Bear and Yuba River basins, west of Lake Tahoe and the Truckee River basin, and north of the Cosumnes and Mokelumne River basins. The area is triangular in shape, the base of the triangle following the crest of the Sierra for about 50 miles. The basin is about 80 miles long, and has a maximum width of 50 miles, and its total area is about 2,000 square miles.

American River is formed by the union of its three principal forks, which rise in the high Sierra at an altitude of 9,000 to 10,000 feet. It flows southwestward to its junction with the Sacramento just above the city of Sacramento, and has a total length of about 110 miles. North and Middle forks each have a length of about 60 miles, a total fall of nearly 8,000 feet, and a total drainage area of 349 and 640 square miles, respectively. South Fork has a length of about 60 miles, a total fall of nearly 9,000 feet, and a total drainage area of 861 square miles. North and Middle forks unite near Auburn, about 20 miles above the mouth of South Fork, which is only a few miles

above Folsom. Each of the forks has many other forks, branches, and tributaries.

Almost half of the American drainage basin has an altitude exceeding 5,000 feet, and probably one-third of it ranges from 6,000 to 9,000 feet. The formation in the upper part is chiefly granite, which has yielded to glacial and erosional action to such an extent as to form many regular ridges and drainage channels.

The lower elevations of the basin have a poor forest cover, being barren, or, at most, sparsely timbered; but the higher elevations support a good growth of timber. All the upper part of the basin, amounting to considerably more than half of the total, is included in a federal forest reserve.

The mean annual precipitation varies from 21 inches in the Sacramento Valley to probably 60 inches near the summit of the Sierra, where it occurs as snow which does not disappear till summer. In the foothill region it ranges from 25 to 30 inches and in the central region from 45 to 55 inches. It is probably somewhat greater in the northern than in the southern part of the basin. At the higher altitudes there is much snow and ice during the winter.

Some water is diverted from the American for irrigation, particularly in the Sacramento Valley, but further development is possible.

Storage development on a big scale is not possible in the American basin, though considerable storage for power and mining is feasible, particularly on Middle and South forks.

The minimum flow of the streams in this basin, with the existing fall, is sufficient to develop about 100,000 horsepower without storage, of which about 40 per cent is on the South Fork and nearly 30 per cent on the Middle Fork.

The upper part of the American basin shows evidence of glaciation, which has left many small lakes, some of which have been dammed and used for storage in connection with mining.

The longest run-off record in this basin extends back to 1904. The wettest year since that time was 1907, and the driest, 1908. The total flow during the wettest year was nearly four times that during the driest.

The only gaging station that has been maintained in the basin is on American River near Fairoaks, 1904 to 1908.

AMERICAN RIVER NEAR FAIROAKS, CAL.

This station, which is located at the Fairoaks highway bridge about 1,000 feet north of the railroad station, was established November 3, 1904, to obtain data for use in connection with studies of flood problem in the Sacramento Valley. The old bridge was destroyed by flood in March, 1907, after which time measurements were made from a temporary bridge until the end of 1908. A new steel bridge was completed early in 1909, and measurements are now made from it.

No important tributaries enter American River above or below Fairoaks, except the South Fork, which joins the main stream about 3 miles above Folsom and about 10 miles above the station.

Some water is diverted for irrigation at points above the station, but the quantity is not known.

The position of the gage has been changed several times during the life of the station, but no change has been made in the datum.

The conditions for obtaining accurate discharge data are poor. The stream is torrential and has a changeable bed; the current is sluggish at low, and very swift at moderate, stages; the flow is disturbed by bars at low water and by concrete piers at other stages, and the channel conditions near the right bank are disturbed by a large eddy, which is very objectionable at all stages except the lowest.

Discharge measurements of American River near Fairoaks, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 5	R. S. Hawley	378	4,300	11.60	24,800
February 20	do	352	2,280	6.00	6,340
March 5	do	353	2,720	7.10	9,590
March 14	do	353	2,630	6.50	8,370
May 10	W. G. Steward	376	3,700	8.35	12,900
May 20	do	384	3,980	9.00	16,800
June 24	W. F. Martin	336	2,460	6.41	7,690
September 17	W. A. Lamb	180	923	2.50	412
November 2	do	320	1,430	2.70	736
1908.					
January 24	W. A. Lamb	361	2,560	5.70	7,260
February 14	do	325	1,580	3.40	1,660
March 16	do	355	2,250	4.95	5,380
April 11	do	360	2,260	4.95	5,680
Do	do	360	2,440	5.52	6,660
April 25	do	361	2,100	4.60	4,460
September 19	W. V. Hardy	64	64	1.50	149
October 6	do	65	72	1.63	176
December 15	W. F. Martin	271	1,350	2.21	694

Daily gage height, in feet, of American River near Fairoaks, Cal., for 1907 and 1908.

[M. J. Ferry, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.0	9.65	5.75	8.55	8.1	9.1	6.85	4.05	2.9	2.4	2.7	2.6
2	4.1	22.75	6.6	9.05	8.1	9.45	7.0	4.0	2.75	2.4	2.7	2.6
3	4.0	15.15	6.25	8.5	8.05	8.85	6.95	3.95	2.7	2.4	2.6	2.6
4	4.05	14.55	6.2	8.4	8.05	8.7	6.9	3.7	2.8	2.4	2.7	2.6
5	5.95	12.3	6.75	8.5	7.9	8.6	7.15	3.5	2.7	2.4	2.7	2.6
6	4.75	10.0	6.9	8.1	7.75	8.5	6.75	3.3	2.7	2.4	2.7	2.75
7	4.45	8.7	6.5	8.0	7.45	8.4	6.1	3.25	2.7	2.4	2.7	3.5
8	4.45	8.1	6.25	8.0	7.1	7.8	6.3	3.45	2.7	2.4	2.7	3.6
9	4.35	7.55	5.6	8.5	7.8	7.3	6.05	3.5	2.7	2.4	2.6	3.45
10	4.15	7.25	8.4	9.0	8.15	7.2	6.0	3.35	2.8	2.4	2.6	4.1
11	3.85	7.0	8.2	9.2	8.8	8.8	6.0	3.4	2.7	2.4	2.6	4.2
12	3.6	6.7	7.75	9.6	8.3	9.3	5.9	3.3	2.7	2.4	2.6	3.6
13	3.8	6.5	6.85	9.95	7.6	8.5	5.65	3.35	2.7	2.4	2.6	3.3
14	3.85	6.4	6.45	10.25	7.1	7.3	5.4	3.3	2.8	2.3	2.6	3.3
15	4.05	6.25	6.15	10.45	7.4	6.15	5.2	3.25	2.7	2.4	2.6	3.25

Daily gage height, in feet, of American River near Fairoaks, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.85	6.3	6.1	9.4	8.0	6.0	4.85	3.0	2.65	2.4	2.6	2.95
17	3.85	6.35	13.4	9.2	8.25	5.9	5.05	3.0	2.45	2.4	2.6	2.9
18	4.15	6.4	20.6	9.3	8.65	6.5	5.0	3.05	2.5	2.4	2.6	2.8
19	3.75	6.15	27.6	9.65	9.45	6.8	5.0	3.05	2.55	2.4	2.6	2.8
20	3.7	6.0	23.8	9.9	9.3	7.3	4.9	3.15	2.55	2.4	2.6	2.75
21	3.65	6.0	21.1	9.45	8.1	7.7	4.85	3.1	2.5	2.4	2.6	2.7
22	3.6	6.8	18.4	9.05	8.0	7.45	4.55	3.0	2.5	2.4	2.6	2.7
23	3.6	6.5	13.5	9.05	7.2	6.9	4.4	3.0	2.5	2.4	2.6	2.7
24	3.65	6.1	13.25	9.2	7.15	6.4	4.4	3.0	2.4	2.4	2.6	2.6
25	4.1	6.75	12.3	9.25	7.55	6.55	4.4	2.9	2.35	2.4	2.6	2.6
26	4.9	6.7	11.5	8.95	7.8	7.1	4.5	3.0	2.4	2.8	2.6	2.7
27	4.8	6.25	10.2	8.85	8.0	7.25	4.25	2.95	2.5	2.85	2.6	6.7
28	8.65	5.95	9.2	8.8	8.3	7.4	4.3	3.0	2.45	2.7	2.6	4.4
29	8.7	.....	8.75	8.6	8.45	7.55	4.3	3.0	2.45	2.7	2.6	3.75
30	6.9	.....	8.55	8.55	8.35	7.3	4.25	3.05	2.4	2.7	2.6	4.35
31	6.1	.....	8.5	.....	8.2	.....	4.25	2.95	.....	2.7	.....	5.5
1908.												
1	4.2	3.5	4.05	4.0	5.6	4.4	3.3	2.0	1.4	1.5	1.9	2.3
2	3.5	3.8	4.3	4.0	5.55	4.45	3.25	2.0	1.5	1.5	1.9	2.3
3	3.5	4.65	4.6	3.8	5.8	4.15	3.25	2.0	1.5	1.5	1.9	2.6
4	3.55	4.7	4.3	4.0	4.8	4.15	3.25	2.0	1.4	1.5	1.8	2.9
5	3.5	4.4	4.0	4.2	4.75	4.05	3.2	1.9	1.5	1.5	1.8	3.5
6	3.3	3.8	3.95	4.2	4.9	4.15	3.1	1.95	1.4	1.5	1.8	3.8
7	3.25	3.7	3.8	4.2	4.75	4.05	3.1	1.9	1.4	1.5	1.8	3.5
8	3.3	3.6	3.8	4.0	4.7	4.35	3.0	1.9	1.5	1.5	1.8	3.15
9	3.2	3.7	3.8	4.0	4.6	4.35	2.95	1.8	1.5	1.5	1.7	2.85
10	3.2	3.7	3.7	4.0	4.5	4.55	2.95	1.8	1.5	1.5	1.6	2.8
11	3.2	3.6	3.8	5.2	4.25	4.4	2.9	1.7	1.4	1.5	1.6	2.6
12	3.65	3.5	3.8	6.0	4.6	4.55	2.95	1.7	1.4	1.5	1.6	2.5
13	3.8	3.5	3.95	5.65	4.6	4.35	2.85	1.7	1.5	1.5	1.5	2.3
14	4.0	3.5	4.4	6.1	4.5	4.35	2.7	1.7	1.5	1.6	1.5	2.2
15	3.7	3.45	4.6	5.75	5.25	4.25	2.7	1.6	1.5	1.8	1.4	2.15
16	3.55	3.4	5.05	5.75	5.05	4.15	2.65	1.6	1.5	3.75	1.4	2.2
17	3.5	3.4	5.0	5.0	4.9	4.1	2.6	1.6	1.5	2.9	1.4	2.1
18	3.5	3.4	5.0	5.0	4.95	3.9	2.5	1.6	1.4	2.6	1.4	2.0
19	3.5	3.35	5.0	5.4	5.1	3.8	2.5	1.6	1.5	2.6	1.4	1.9
20	3.9	3.3	4.95	6.05	5.0	3.7	2.4	1.5	1.5	2.5	1.4	1.8
21	5.5	3.3	4.85	5.9	5.2	4.2	2.3	1.5	1.5	2.3	2.9	1.75
22	5.55	3.25	4.75	5.5	5.35	3.8	2.3	1.5	1.5	2.2	3.2	1.6
23	5.9	3.2	4.6	5.15	5.2	3.7	2.2	1.5	1.5	2.1	3.0	.....
24	5.75	3.1	4.5	4.8	5.25	3.5	2.2	1.5	1.5	2.1	3.0	.....
25	5.0	3.2	5.0	4.65	5.5	3.6	2.2	1.5	1.5	2.0	2.9	.....
26	4.45	3.3	4.8	4.8	5.4	3.6	2.2	1.5	1.5	2.0	2.8	.....
27	4.1	3.4	4.5	4.7	5.55	3.45	2.1	1.5	1.5	2.0	2.6	.....
28	4.0	3.55	4.3	5.5	5.1	3.4	2.0	1.5	1.5	2.0	2.5	.....
29	3.7	4.0	4.3	5.4	5.05	3.4	2.0	1.5	1.5	2.0	2.4	.....
30	3.7	.....	4.3	5.55	5.1	3.2	2.0	1.4	1.5	2.0	2.3	.....
31	3.55	.....	4.1	.....	4.95	.....	2.0	1.5	.....	1.9	.....	.....

NOTE.—Gage heights observed for December 23 to 31 are believed to be in error and have been discarded.

Rating tables for American River near Fairoaks, Cal.

JANUARY 1 TO MARCH 19, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	100	2.50	1,080	4.40	3,460	11.00	23,300
.90	130	2.60	1,170	4.60	3,820	12.00	27,700
1.00	165	2.70	1,260	4.80	4,200	13.00	32,300
1.10	205	2.80	1,350	5.00	4,600	14.00	37,100
1.20	250	2.90	1,450	5.20	5,020	15.00	42,000
1.30	300	3.00	1,550	5.40	5,450	16.00	47,000
1.40	355	3.10	1,660	5.60	5,890	17.00	52,000
1.50	410	3.20	1,770	5.80	6,340	18.00	57,000
1.60	465	3.30	1,880	6.00	6,800	19.00	62,000
1.70	520	3.40	2,000	6.20	7,260	20.00	67,000
1.80	580	3.50	2,120	6.40	7,740	21.00	72,000
1.90	640	3.60	2,250	6.60	8,220	22.00	77,000
2.00	700	3.70	2,380	6.80	8,700	23.00	82,000
2.10	770	3.80	2,520	7.00	9,200	24.00	87,000
2.20	840	3.90	2,660	8.00	12,100	25.00	92,000
2.30	920	4.00	2,810	9.00	15,400	26.00	97,000
2.40	1,000	4.20	3,120	10.00	19,200	27.00	102,000

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to March, 1907, and later high-water measurements, and is fairly well defined between gage heights 0.9 feet and 13.1 feet. Above gage height 15 feet the rating curve is a tangent, the difference being 500 per tenth.

MARCH 20, 1907, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	100	2.40	640	3.40	1,640	4.80	4,080
1.50	130	2.50	720	3.50	1,770	5.00	4,500
1.60	160	2.60	800	3.60	1,910	5.20	4,960
1.70	200	2.70	890	3.70	2,060	5.40	5,420
1.80	240	2.80	980	3.80	2,220	5.60	5,880
1.90	290	2.90	1,080	3.90	2,390	5.80	6,340
2.00	350	3.00	1,180	4.00	2,560	6.00	6,800
2.10	420	3.10	1,290	4.20	2,920		
2.20	490	3.20	1,400	4.40	3,290		
2.30	560	3.30	1,520	4.60	3,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on ten discharge measurements made during 1907 to 1909, and is fairly well defined between gage heights 1.5 feet and 13.1 feet. Above gage height 6.0 feet the rating curve is the same as the preceding.

Monthly discharge of American River near Fairoaks, Cal., for 1907 and 1908.

[Drainage area, 1,910 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	14,400	2,250	4,150	2.17	2.50	255,000	A.
February	80,800	6,680	14,800	7.75	8.07	822,000	A.
March	105,000	6,220	24,700	12.9	14.87	1,520,000	B.
April	21,000	12,100	15,600	8.17	9.12	928,000	A.
May	17,000	9,470	12,200	6.39	7.37	750,000	A.
June	17,000	6,570	11,100	5.81	6.48	660,000	A.
July	9,600	3,010	5,510	2.88	3.32	339,000	A.
August	2,650	1,080	1,500	.785	.90	92,200	A.
September	1,080	600	813	.426	.48	48,400	B.
October	1,030	560	693	.363	.42	42,600	B.
November	890	800	821	.430	.48	48,900	B.
December	8,460	800	1,790	.937	1.08	110,000	A.
The year	105,000	569	7,810	4.08	55.09	5,620,000	

Monthly discharge of American River near Fairoaks, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	6,570	1,400	2,600	1.36	1.57	160,000	A.
February	3,880	1,290	1,960	1.03	1.11	113,000	A.
March	4,620	2,060	3,290	1.72	1.98	202,000	A.
April	7,030	2,220	4,490	2.35	2.62	267,000	A.
May	6,340	3,010	4,590	2.40	2.77	282,000	A.
June	3,580	1,400	2,600	1.36	1.52	155,000	A.
July	1,520	350	870	.455	.52	53,500	B.
August	350	100	200	.105	.12	12,300	B.
September	130	100	123	.064	.07	7,320	B.
October	2,140	130	384	.201	.23	23,600	B.
November	1,400	100	441	.231	.26	26,200	B.
December[a]	2,220	160	605	.317	.37	37,200	B.
The year	7,030	100	1,850	.966	13.14	1,340,000	

[a] Discharge estimated as 160 second-feet December 23 to 31.

SAN JOAQUIN RIVER BASIN.

DESCRIPTION.

The San Joaquin drainage basin is the southern lobe of the great central basin of California, and lies southeast of an imaginary line drawn from San Francisco Bay to Lake Tahoe. The rim of the basin is determined by the crest of the Sierra Nevada at the east, the Tehachapi Range at the south, and the Coast Range at the west. The basin is somewhat larger than the Sacramento basin, with which it merges at the north. It has a length of about 280 miles northwest-southeast and a width of about 125 miles. It is roughly rectangular in shape, and has a total area of about 32,700 square miles.

San Joaquin River rises in the high Sierra south of the Yosemite National Park, about halfway between the north and south ends of the basin, and flows southwestward to the trough of the San Joaquin Valley, whence it takes a northwestward course to its mouth. It has a total length of approximately 350 miles—125 miles in the mountains and 225 in the valley. It discharges into Suisun Bay, about 50 miles by water from San Francisco. It is navigable as far as Stockton, about 50 miles above its mouth.

All the important tributaries of San Joaquin drain parts of the western slope of the Sierra, take a course parallel to the upper San Joaquin—that is, southwestward, and enter from the east. In order from south to north they are Fresno, Chowchilla, Merced, Tuolumne, Stanislaus, Calaveras, and Mokelumne rivers. The principal streams from the Sierra south of the upper San Joaquin, in order from north to south, are Kings, Kaweah, Tule, and Kern rivers. These last-named streams, however, are not directly tributary to

the San Joaquin, for they are lost in the Tulare Lake depression, which under normal conditions has no surface outlet to the San Joaquin. Kings River discharges partly into Tulare Lake and partly into the San Joaquin. Besides the North, Middle, and South forks, the upper San Joaquin has many other smaller tributaries, like all other Sierra streams.

Topographically the San Joaquin basin comprises three parallel strips of country having marked physical differences—(1) the eastern slope of the Coast Range, having an average width of about 15 miles and a comparatively gentle slope incised by the action of short, torrential, intermittent streams; (2) the western slope of the Sierra, having an average width of about 65 miles and a long steep slope deeply cut by many long perennial streams; and (3) the central plain, known as the San Joaquin Valley, having an average width of nearly 45 miles and a very light slope northwestward.

The eastern slope of the Coast Range has an area somewhat less than 4,000 square miles and is made up chiefly of sandstones, shales, and conglomerates. It ranges in elevation from a few hundred feet at the edge of the valley to a few thousand at the crest.

The Sierra slope has an area of about 16,000 square miles, or half the total area of the San Joaquin basin. This slope consists chiefly of granites and metamorphic sedimentary and igneous rocks. The altitude of the slope ranges from a few hundred feet in the foothills to more than 14,000 feet at the crest of the Sierra. Mount Whitney, the highest peak near the southern end of the range, has an elevation of 14,501 feet above sea level. The valleys, canyons, and water-falls of some of the principal streams, particularly Kings, Merced, and Tuolumne rivers, are famous for their beauty.

The lowland known as the San Joaquin Valley is a great structural trough which owes its present condition to fluvial erosion and transportation. It is about 250 miles long and 45 miles wide, and has an area of 11,500 square miles. It is divided into an east side and a west side plain by the trough axis, or line of lowest depression, which is everywhere much nearer the western than the eastern foothills. At some places the axis lines near the western hills; at others, the west side slopes are 15 or 18 miles wide, or about one-half as wide as the east side slopes. The west side slopes are steeper than those of the east. Gradients of less than 6 or 8 feet to the mile are unusual, and gradients of 20 or even 40 feet to the mile are common. On the east side the maximum grade is about 30 feet to the mile, while 5 feet or less is about the average.

The unsymmetrical form of the valley floor arises from the difference in the character of the streams tributary to each side. The east side streams being in every way more important than those from the west,

particularly with regard to volume and distribution of flow, build up flatter but more extensive deltas, or alluvial fans than are built by the smaller more erratic and torrential streams from the west.

The general slope of the valley is upward from north to south and from the central axis toward the hills on each side. The topography of the San Joaquin Valley is the result of a combination of alluvial fan surfaces which have their apexes at the mouths of the canyons of the tributary streams, and extend outward into the valley, coalescing laterally and terminally. The fans of Kings River on the east and Los Gatos Creek on the west have united, forming a delta-dam across the trough of the valley, which separates the Tulare basin on the south from the lower part of the main valley. Likewise Kern River has extended its delta to the McKittrick Hills, separating Buena Vista and Kern Lake basin at the south from the Tulare basin at the north.

Large areas in the northern end of San Joaquin Valley are inundated during the spring floods unless protected by artificial levees. The greater part of the flood waters come from the Sacramento system, but the most disastrous consequences result from the simultaneous flooding of the two systems. The alluvial fans are less pronounced at the north than at the south end, but they are, nevertheless, predominant along the valley borders.

Some parts of the San Joaquin basin have a good forest cover; others are practically barren. The upper reaches of the Coast Range have a light brush and timber cover, but the foothills are bare. The main valley is treeless except at a few places along water courses or irrigated areas. The foothills of the Sierra have a good covering of grass, brush, and scattering timber, which increases in density with elevation. Above the foothills zone there is a heavy timber growth which extends to an altitude of about 10,000 feet, above which contour there is little, if any, timber. The famous California big trees (*Sequoia gigantea*) occur on the Sierran slope of this basin. About 65 per cent of the Sierran slope is included in national forest reserves and parks.

The mean annual precipitation in the San Joaquin basin varies with elevation, latitude, and longitude. The southern part of the central valley is strictly arid, the rainfall there being less than 5 inches annually, but northward along the trough of the valley the rainfall gradually increases until, at the north end, it averages nearly 20 inches. The west-side slope has a light rainfall, which increases progressively northward. In the Sierra region the precipitation increases with elevation up to about 5,000 feet, and then decreases somewhat up to the summit. The same progressive increase from south to north that exists in the valley continues along the summit.

This is well shown by the total run-off from the northern and southern Sierra, which amounts to about 11,500,000 acre-feet annually. Of this amount, about 3,000,000 acre-feet are supplied by the streams south of the upper San Joaquin from about 7,500 square miles, and 8,500,000 acre-feet by the San Joaquin and tributaries to the north from about 5,100 square miles.

The precipitation occurs during the "rainy season," which begins in the late fall and ends in early spring. The snowfall is heavy in the higher mountain region and does not disappear until late summer. Much ice occurs in the higher altitudes, but does not interfere with stream measurements.

The San Joaquin Valley, like the Sacramento Valley to the north, offers great opportunities for irrigation development. Practically all the Sierra streams are now drawn upon for irrigation to a greater or less extent. For the fullest development of the valley, however, the surface supply will have to be augmented by waters drawn from underground sources.[a]

The basin affords many storage sites, some of them being very large. More or less storage is already utilized for power development in the Sierra.

The minimum flow of the streams is sufficient to generate about 600,000 horsepower without storage. This amount could be increased to about 1,500,000 horsepower with storage. The most important streams for power development are the upper San Joaquin, Kings, and Kern rivers, each of which could develop considerably more than 100,000 horsepower without storage. The development at the present time is about 115,000 horsepower.

Numerous small glacial lakes and smooth, bare domes and ridges bear testimony to the former presence of a great glacial ice sheet. Undoubtedly the famous Yosemite Valley owes its exquisite grandeur in part to glaciation. Small glaciers still protrude themselves from the summits of the highest peaks.

The longest run-off record in the San Joaquin basin dates back as far as 1893, when a gaging station was established on Kern River near Bakersfield. Yearly records have been kept on Kern River since 1894, and on Kings, Tuolumne, and Stanislaus rivers since 1896. The wettest year on record was 1907 for the streams north of upper San Joaquin River, and 1906 for those south of the San Joaquin. The driest year was 1898. The total flow of the wettest year on the different streams was from four to eight times that of the driest.

---

[a] Mendenhall, W. C., Preliminary report on the ground waters of the San Joaquin Valley: Water-Supply Paper U. S. Geol. Survey No. 222, 1908.

Investigations of flow have been made on San Joaquin River and on the following stream tributaries to it and to Tulare Lake:

Kern River.	Tuolumne River.
Tule River.	Stanislaus River.
Kaweah River.	Calaveras River.
Kings River.	Mokelumne River.
Merced River.	Cosumnes River.

Gaging stations have been maintained on the main stream as follows:

San Joaquin River near Pollasky (1907 to 1908).
San Joaquin River at Herndon (1879 to 1908).

MAIN SAN JOAQUIN RIVER.

SAN JOAQUIN RIVER NEAR POLLASKY, CAL.

This station, which is located at the Fort Miller ranch house, about 4 miles above the town of Pollasky, was established October 18, 1907, to obtain general statistical data regarding the flow of the river. The data are useful also in connection with irrigation and power development and for studies of flood problems in the San Joaquin Valley.

No important tributaries enter near the station and no diversions are made above except for water-power development, all such diverted water being returned to the river channel above the station. The entire flow of the stream is controlled by existing water rights, involving all irrigable lands tributary to San Joaquin River.

No change has been made in the gage datum.

Conditions for obtaining accurate discharge data are fair. At low stage the current is very sluggish, but at such times check measurements can be made from the bridge at Pollasky. The channel is subject to slight change which may somewhat affect the accuracy.

Discharge measurements of San Joaquin River near Pollasky, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 1 [a]	Clapp and Hardy	198	336	.....	508
October 21	W. V. Hardy	220	720	3.80	541
1908.					
February 27	W. F. Martin	.....	.....	4.50	1,240
May 4	W. A. Lamb	237	1,380	6.65	3,710
June 13	W. F. Martin	238	1,380	6.98	4,000
July 30	W. V. Hardy	223	955	4.85	1,600
August 20	do	222	751	4.08	710
August 21	do	222	751	4.05	638
August 22	do	222	751	4.05	635
September 5	do	222	682	3.75	419
October 16	do	222	640	3.54	308
December 7	W. F. Martin	222	660	3.70	388

[a] Measurement made at concrete bridge at Pollasky, Cal.

Daily gage height, in feet, of San Joaquin River near Pollasky, Cal., for 1907 and 1908.

[George Hames and E. G. Davis, observers.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1		4.1	3.5	11		3.8	5.4	21	3.8	3.6	3.9
2		4.1	3.5	12		3.75	4.25	22	3.8	3.65	3.85
3		4.0	3.5	13		3.75	4.2	23	3.9	3.65	3.85
4		4.0	3.5	14		3.7	4.15	24	3.9	3.6	3.85
5		3.85	3.55	15		3.7	4.1	25	4.0	3.6	3.85
6		3.85	3.75	16		3.7	4.1	26	3.95	3.6	3.9
7		3.85	4.5	17		3.7	4.0	27	4.1	3.6	3.9
8		3.85	3.95	18	3.8	3.65	3.9	28	4.3	3.6	3.95
9		3.85	4.0	19	3.8	3.65	3.9	29	4.3	3.6	4.1
10		3.8	4.2	20	3.8	3.6	3.9	30	4.2	3.6	4.5
								31	4.2		4.3

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.15	4.2	5.45	4.8	8.6	6.05	5.6	5.0	3.75	3.8	3.65	3.5
2	4.1	5.0	4.6	4.75	8.3	6.0	5.6	5.3	3.7	3.75	3.6	3.55
3	4.1	4.8	4.6	4.7	7.8	5.8	5.7	5.2	3.7	3.7	3.6	3.6
4	4.1	4.8	4.55	4.9	7.1	5.5	5.7	6.3	3.7	3.65	3.55	3.8
5	4.1	4.6	4.4	5.2	6.4	5.6	5.75	6.0	3.75	3.6	3.55	3.7
6	4.1	4.4	4.55	5.2	6.8	5.8	5.9	5.2	3.8	3.65	3.55	3.7
7	4.05	4.3	4.55	5.2	7.8	5.85	5.7	5.0	3.9	3.7	3.5	3.7
8	4.0	4.2	4.55	5.0	6.8	5.95	5.5	4.9	4.1	3.7	3.5	3.6
9	4.0	4.15	4.55	5.1	6.3	6.4	5.5	4.7	4.2	3.65	3.55	3.65
10	4.0	4.15	4.55	5.0	5.9	6.85	5.2	4.8	4.05	3.6	3.55	3.65
11	4.0	4.2	4.6	5.7	5.3	6.85	5.6	4.8	4.0	3.55	3.5	3.65
12	4.0	4.2	4.6	6.1	5.8	6.7	5.35	4.55	4.35	3.55	3.5	3.6
13	4.0	4.2	4.6	6.6	5.6	6.6	5.45	4.5	4.15	3.55	3.5	3.55
14	4.2	4.2	5.0	7.3	5.8	6.7	5.35	4.35	4.0	3.55	3.5	3.5
15	4.4	4.2	5.0	6.8	5.9	6.65	5.1	4.35	3.95	3.55	3.5	3.5
16	4.45	4.15	5.0	6.7	5.85	6.5	4.9	4.3	3.9	3.55	3.45	3.6
17	4.25	4.25	5.25	6.5	5.55	6.45	4.8	4.15	3.9	4.0	3.45	3.5
18	4.15	4.2	6.0	6.8	5.6	6.0	4.8	4.15	4.0	3.85	3.45	3.5
19	4.05	4.2	6.0	7.4	5.65	5.9	4.8	4.1	4.0	3.8	3.45	3.5
20	4.05	4.2	5.1	7.8	5.95	5.9	4.8	4.05	4.05	3.75	3.45	3.5
21	4.05	4.25	6.0	7.8	5.75	5.75	4.8	4.05	4.05	3.75	3.45	3.5
22	4.1	4.2	5.9	6.9	6.1	5.7	4.8	4.05	3.95	3.65	3.45	3.55
23	4.05	4.2	6.0	6.6	6.2	5.65	4.8	4.05	3.9	3.6	3.55	3.6
24	4.1	4.2	6.0	6.3	7.1	5.5	4.8	4.0	4.2	3.7	3.6	3.55
25	4.6	4.2	5.85	6.2	6.95	5.65	4.8	3.95	4.5	3.75	3.65	3.5
26	4.2	4.2	5.7	6.4	7.0	5.85	4.75	3.95	4.2	3.75	3.65	3.5
27	5.15	4.2	6.0	7.4	6.8	5.85	4.75	3.9	4.1	3.75	3.55	3.5
28	4.8	4.2	6.0	8.2	6.95	5.65	4.7	3.9	4.0	3.7	3.55	3.5
29	4.4	5.5	5.3	8.5	7.2	5.6	4.9	3.85	3.9	3.7	3.55	3.5
30	4.2		5.1	8.6	7.1	5.65	4.9	3.8	3.8	3.65	3.5	3.55
31	4.2		5.0		6.5		5.0	3.8		3.65		3.55

Rating table for San Joaquin River near Pollasky, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	190	4.80	1,510	6.20	3,160	7.60	4,855
3.50	250	4.90	1,625	6.30	3,280	7.70	4,980
3.60	320	5.00	1,740	6.40	3,400	7.80	5,105
3.70	400	5.10	1,855	6.50	3,520	7.90	5,230
3.80	480	5.20	1,970	6.60	3,640	8.00	5,355
3.90	570	5.30	2,085	6.70	3,760	8.10	5,480
4.00	660	5.40	2,200	6.80	3,880	8.20	5,610
4.10	760	5.50	2,320	6.90	4,000	8.30	5,740
4.20	860	5.60	2,440	7.00	4,120	8.40	5,870
4.30	960	5.70	2,560	7.10	4,240	8.50	6,000
4.40	1,070	5.80	2,680	7.20	4,360	8.60	6,130
4.50	1,180	5.90	2,800	7.30	4,480		
4.60	1,290	6.00	2,920	7.40	4,605		
4.70	1,400	6.10	3,040	7.50	4,730		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made during 1907 and 1908, and is fairly well defined between gage heights 3.5 and 7.0 feet.

Monthly discharge of San Joaquin River near Pollasky, Cal., for 1907 and 1908.

[Drainage area, 1,640 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
October 18–31	.....	.....	658	0.401	0.46	40,500	A.
November	760	320	441	.269	.30	26,200	A.
December	2,200	250	659	.402	.46	40,500	A.
1908.							
January	1,910	660	864	.527	.61	53,100	A.
February	2,320	810	1,010	.616	.66	58,100	A.
March	2,920	1,070	1,950	1.19	1.37	120,000	A.
April	6,130	1,400	3,350	2.04	2.28	199,000	A.
May	6,130	2,080	3,560	2.17	2.50	219,000	A.
June	3,940	2,320	2,960	1.80	2.01	176,000	A.
July	2,800	1,400	1,930	1.18	1.36	119,000	A.
August	3,280	480	1,190	.726	.84	73,200	A.
September	1,180	400	655	.399	.45	39,000	A.
October	660	285	388	.237	.27	23,900	A.
November	360	220	272	.166	.19	16,200	B.
December	480	250	301	.184	.21	18,500	A.
The year	6,130	220	1,540	.936	12.75	1,120,000	

SAN JOAQUIN RIVER AT HERNDON, CAL.

This station is at the Southern Pacific Railroad bridge, about 12 miles northwest of Fresno and 20 miles below Pollasky. In 1879 the engineering department of the Southern Pacific Company set a gage on the old trestle bridge, which was used for the regular gaging station established at the beginning of 1895. In 1899, the trestle was replaced by a steel bridge, to the center pier of which a new gage was placed at the datum of the old gage. Meter measurements were discontinued at the end of 1901, because of the continual change in the section due to shifting sand. Since that date only a gage record has been kept.

The following record has been furnished by William Hood, chief engineer of the Southern Pacific Company.

Daily gage height, in feet, of San Joaquin River at Herndon, Cal., for 1907 and 1908.

[Southern Pacific Railway Company, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.65	5.5	4.75	6.65	9.65	11.25	10.25	6.6	3.25	2.6	3.15	2.85
2	3.65	5.35	4.65	7.0	9.5	11.35	9.5	6.75	3.25	2.6	3.0	3.6
3	4.0	5.1	4.6	7.5	9.5	11.75	9.65	6.65	3.15	2.6	3.0	3.5
4	4.15	5.0	4.6	7.5	9.35	11.6	10.9	6.65	3.0	2.6	3.0	3.35
5	4.15	5.0	4.75	7.6	8.65	11.35	10.5	6.25	3.0	2.6	3.0	3.35
6	4.35	4.85	7.65	7.35	8.35	11.0	9.75	6.0	3.0	2.6	3.0	3.15
7	4.5	4.85	6.4	7.15	8.0	9.9	9.85	5.9	3.0	2.6	3.0	3.0
8	4.65	4.75	6.4	7.4	7.65	9.0	9.35	5.9	3.0	2.6	3.0	3.0
9	5.0	4.75	6.15	7.65	8.25	8.9	9.1	5.75	3.0	2.6	3.0	3.25
10	5.0	4.65	7.35	8.15	8.5	9.6	8.65	5.5	3.0	2.6	3.0	3.4
11	4.5	4.75	8.5	9.0	8.65	9.9	8.5	5.5	3.0	2.6	3.0	3.4
12	4.35	5.0	8.35	9.25	9.0	9.35	8.15	5.15	3.0	2.6	3.0	3.35
13	4.35	5.0	7.25	9.0	8.5	8.5	8.75	5.1	3.0	2.6	3.0	3.35
14	4.35	5.0	6.5	9.5	8.0	8.25	8.5	5.0	3.0	2.4	3.0	3.6
15	4.35	5.0	5.65	9.35	8.0	7.65	8.1	5.0	3.0	2.4	3.0	3.75
16	4.35	5.0	7.35	8.75	8.35	7.5	7.9	5.15	3.0	2.4	3.0	3.75
17	4.35	5.0	8.5	8.6	9.5	7.15	7.65	5.15	3.0	2.25	3.0	3.65
18	4.35	5.0	10.0	8.5	10.0	7.5	7.5	5.35	2.9	2.25	3.0	3.65
19	4.4	5.0	9.15	8.5	10.5	8.15	8.0	5.15	2.9	2.25	3.0	3.65
20	4.4	5.0	11.5	9.0	10.0	9.1	7.5	5.0	2.85	2.25	3.0	3.65
21	4.4	5.0	11.5	9.25	10.35	9.5	7.65	4.85	2.85	2.25	2.9	3.65
22	4.5	5.0	7.15	9.35	10.25	9.35	7.15	4.75	2.75	2.25	2.9	3.65
23	4.4	6.5	7.0	9.65	8.9	9.15	6.9	4.25	2.75	2.25	2.9	3.65
24	4.35	5.35	11.0	10.0	8.75	8.85	7.1	4.25	2.65	2.25	2.85	3.65
25	4.35	5.15	9.5	10.0	9.0	9.1	7.5	4.0	2.65	2.25	2.85	3.65
26	4.4	5.15	9.0	9.65	9.35	9.4	7.4	4.0	2.65	2.35	2.85	3.65
27	4.5	5.15	7.5	9.6	9.5	9.65	7.15	4.0	2.6	2.4	2.85	3.65
28	4.65	5.0	7.0	9.6	9.25	9.85	7.0	3.85	2.6	2.65	2.85	3.65
29	10.0	.....	6.35	9.5	10.5	9.75	7.0	3.85	2.6	3.0	2.85	3.65
30	7.35	.....	6.5	10.0	10.25	10.65	6.9	3.5	2.6	3.15	2.85	3.65
31	5.5	.....	7.0	.....	11.15	.....	6.9	3.5	.....	3.15	.....	3.65
1908.												
1	3.7	3.75	4.25	4.0	8.0	6.6	4.7	3.5	2.85	2.6	2.5	2.35
2	3.75	3.75	4.25	4.0	8.0	6.25	4.7	3.5	2.75	2.6	2.5	2.35
3	3.75	3.75	4.25	4.0	7.5	6.1	4.7	4.15	2.75	2.6	2.5	2.35
4	3.75	3.75	3.9	4.0	7.35	6.0	5.0	5.25	2.7	2.6	2.5	2.35
5	3.75	3.75	3.75	4.0	6.7	5.7	5.0	5.5	2.7	2.5	2.5	2.35
6	3.75	3.75	3.75	4.35	5.75	5.6	5.15	5.25	2.7	2.5	2.5	2.35
7	3.75	3.75	3.75	4.25	5.7	5.25	5.15	5.1	2.6	2.5	2.5	2.35
8	3.75	3.75	3.7	4.1	5.7	5.15	5.15	4.7	2.6	2.5	2.5	2.35
9	3.75	3.75	3.6	4.0	5.75	6.15	5.1	4.5	2.9	2.5	2.5	2.35
10	3.75	4.0	3.6	4.0	5.75	6.25	5.1	4.5	2.85	2.5	2.4	2.35
11	3.75	4.0	3.7	5.15	5.5	6.25	5.1	4.15	2.75	2.5	2.4	2.35
12	3.75	3.7	3.7	5.6	5.4	6.35	4.75	4.0	2.75	2.5	2.4	2.35
13	3.7	3.7	3.7	6.0	5.25	6.35	4.7	4.0	2.75	2.5	2.4	2.35
14	3.7	3.7	4.1	6.15	5.0	6.5	4.7	4.0	2.7	2.5	2.4	2.35
15	3.75	3.7	4.35	6.25	5.15	6.7	4.4	4.0	2.7	2.5	2.35	2.35
16	3.75	3.7	4.75	6.4	5.0	6.7	4.35	4.0	2.7	2.5	2.35	2.35
17	3.75	3.6	5.35	6.25	5.0	6.6	4.15	4.0	2.7	2.6	2.35	2.35
18	3.7	3.6	5.6	6.0	5.0	6.15	4.0	3.7	2.6	2.6	2.35	2.35
19	3.7	3.6	5.7	5.75	5.0	6.0	4.0	3.6	2.6	2.6	2.35	2.35
20	3.6	3.6	5.7	5.6	5.0	5.5	4.0	3.6	2.6	2.7	2.35	2.35
21	3.6	3.6	5.25	6.4	5.0	5.15	3.75	3.5	2.6	2.6	2.35	2.35
22	3.6	3.6	5.5	6.35	5.35	5.0	3.75	3.5	2.6	2.6	2.35	2.35
23	3.6	3.6	5.0	6.35	5.35	4.75	3.75	3.5	2.6	2.6	2.35	2.35
24	3.6	3.5	5.25	6.15	6.25	4.75	3.7	3.5	2.6	2.6	2.35	2.35
25	3.6	3.5	5.35	6.1	6.5	5.0	3.7	3.35	2.6	2.6	2.35	2.35
26	3.75	3.5	5.35	6.0	6.75	5.0	3.7	3.25	2.7	2.5	2.35	2.35
27	3.75	3.5	5.25	6.0	6.7	5.0	3.6	3.25	2.75	2.5	2.35	2.35
28	3.75	3.5	5.0	6.6	6.7	5.15	3.6	3.1	2.7	2.5	2.35	2.35
29	3.75	3.6	4.6	7.7	6.7	5.25	3.6	3.0	2.7	2.5	2.35	2.35
30	3.75	.....	4.5	8.0	6.5	5.4	3.5	3.0	2.7	2.5	2.35	2.35
31	3.75	.....	4.15	.....	6.5	.....	3.5	3.0	.....	2.5	.....	2.35

TULARE LAKE BASIN.

DESCRIPTION.

The Tulare Lake basin is situated near the south end of the San Joaquin Valley and embraces that part of the valley determined by the Kings River delta at the north and the Kern River delta at the south. These rivers leave the foothills and enter the valley near Fresno and Bakersfield, respectively. Strictly speaking, they are tributaries of San Joaquin River, but in reality no water from Kern River has reached the San Joaquin in recent years. Only a part of Kings River enters the San Joaquin.

Below the foothills the Kings and Kern River channels roughly parallel each other in a southwestern direction. They are about 90 miles apart and their courses are approximately at right angles to the axis, or old trough, of the valley. During past centuries each of these streams has brought down an immense quantity of eroded material and deposited it in the valley along its course, the result of the deposition being the pronounced delta fans that extend completely across the valley as the Kings and Kern River ridges. The delta ridge formed by Kern River extends westward to the McKittrick hills and cuts off a small basin in the extreme south end of the San Joaquin Valley, which may be called Kern basin. This basin has several small lakes, of which Kern reservoir is the largest and occupies the lowest depression. Kern River drains into this basin.

North of the Kern and south of the Kings River ridge is another broad but shallow depression known as the Tulare Lake basin or the "valley of the tules." Its lowest area lies in the trough of the San Joaquin Valley and for several hundred years has been covered most of the time by a shallow fresh-water lake. The lake was originally a delta swamp and has always fluctuated in depth and extent, depending upon the season and the caprice of the delta rivers supplying it. Probably within the last hundred years the entire flow of Kern, Tule, and Kaweah rivers has entered this lake and a large part, if not all, of Kings River; but at the present time only the Kaweah and the Tule, south of Kings and north of Kern River, are wholly tributary to the Tulare basin. At high stages Kings River discharges in part into this basin, and sometimes overflow may reach it from the Kern basin at the south.

TULARE LAKE IN KINGS COUNTY, CAL.

Tulare Lake is a shallow body of water occupying the lowest depression in the Tulare basin. It is about 30 miles directly south of Fresno and 40 miles northwest of Bakersfield. The lake is roughly rectangular in shape, and its greatest length is from northwest to southeast. In November, 1907, when its margin was carefully determined, the

lake had an area of about 274 square miles, a maximum depth of 12.4 feet, an average length of 20 miles, and a width of 13.5 miles; the water's edge was 3 miles from the town of Corcoran, and the water surface about 12 feet below. The lake reached its greatest height in the summer of 1907, when it had a maximum depth of nearly 14 feet.

For the twenty-five years preceding 1898 the lake level was steadily lowered, with only seasonal fluctuations. This lowering was in part brought about by the development of irrigation in Tulare basin, the water used for this purpose being diverted from the streams supplying the lake; but undoubtedly the chief factor in producing subsidence was light precipitation. During this entire period the precipitation was generally below the normal, particularly during the several years immediately preceding 1898, and in that year the lake bed became practically dry, and after partly refilling in 1901, it became completely dry in 1905. As the water receded a constantly increasing area of exceedingly fertile land was uncovered. From time to time this land was leveed on the lake side and cultivated, until, in the early spring of 1906, the entire lake bed was under cultivation.

On March 15, 1906, the first water reached the lake bed at the mouth of Kings River, and began spreading out over a large area of bottom land, upon which stood a crop of wheat almost matured. A few days later water from Kaweah and Tule rivers reached the lake. Then began a steady rise which rapidly submerged an increasingly large area of wheat fields. On June 1 the water was 7 feet deep, and covered about 200 square miles. On June 23, overflow water from Kern basin cut through the sand ridge to the south and flowed into the lake, which, for a few days afterwards, rose at the rate of 0.2 foot a day. On August 4 the water reached its greatest height for the year 1906, and the lake had an area of about 300 square miles and a maximum depth of 12.7 feet. The total rise of the lake in 1906 was 10.8 feet. From this date the lake level slowly subsided until December 9, after which a rise began which continued until July, 1907, when the lake attained a maximum depth of 14 feet. Since this date it has been gradually subsiding.

The lake bed resembles a large flat saucer. The flat, level area in the bottom has an elevation of approximately 180 feet above mean sea level and covers about 55 square miles. The lowest point on the crest of the delta ridge to the north is about 27 feet higher than the bottom of the lake. Natural overflow will not occur, therefore, until the lake has a maximum depth of nearly 30 feet and an area of nearly 1,000 square miles.

The lake receives practically all its water from Kings, Kaweah, and Tule rivers. Kings River furnishes the largest quantity. During flood periods about half of the total flow below all diversions enters

the lake. Under normal conditions all the water of Tule River and nearly all that of Kaweah River is diverted for irrigation, and only a small quantity of water from these streams reaches the lake. The water from Kern River is stored in Kern basin except in years of great run-off. It is said that previous to 1906 no water had reached the lake from Kern River for twenty-five years. It thus appears that in years of great run-off, like 1906 and 1907, there will always be a large flow into the lake. Owing to variation in the inflow, therefore, and in the evaporation, which amounts to about 4.5 feet a year, it is probable that the lake will continue to fluctuate very much as in the past, though possibly never reaching very high stages.

The sudden reappearance of Tulare Lake has resulted in a financial loss of millions of dollars. Naturally great interest attaches to the probable behavior of the lake in the future, since permanent reclamation is ultimately hoped for. Whether the lake is destined to dry up or remain a body of water with great fluctuations, as in the past, or whether it is to fill and subside alternately, are questions of great importance.

During 1906 and a part of 1907, a record of the stage of the lake was kept by means of a government gage located near the entrance of Kings River near Lemoore, Cal., at the middle of sec. 4, T. 21 S., R. 20 E., Mount Diablo base and meridian. The record was kept by Mark Lovelace, of Lemoore, Cal. The zero of the gage is at an elevation of 175.1 feet above mean sea level, or 4 feet below the bottom of the lake (elevation 179.1 feet). On May 11, 1907, a gage was set near Corcoran, Cal., and after that date readings were made by D. W. Lewis, of Corcoran, Cal. All lake gage heights have been adjusted to refer to the gage datum near Lemoore, Cal.

Below is the gage record, showing the actual depth of the water on the lowest point of the lake bed, and the variations in level during the last three years.

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
1							10.1	12.4	12.1	11.4	10.9	10.6
2							10.2	12.6	12.0	11.4	10.9	10.6
3							10.3	12.6	12.0	11.4	10.9	10.6
4							10.4	12.6	12.0	11.4	10.9	10.6
5							10.5	12.6	11.9	11.3	10.9	10.6
6						7.6	10.6	12.6	11.9	11.3	10.9	10.6
7						7.7	10.7	12.7	11.8	11.3	10.9	10.6
8						7.8	10.8	12.7	11.8	11.3	10.8	10.6
9						7.9	10.9	12.7	11.8	11.3	10.8	10.6
10						8.0	11.0	12.6	11.7	11.3	10.8	10.6
11						8.0	11.1	12.6	11.7	11.2	10.8	10.6
12						8.1	11.2	12.6	11.7	11.2	10.8	10.6
13						8.1	11.4	12.6	11.7	11.2	10.8	10.6
14						8.2	11.5	12.5	11.7	11.2	10.8	10.6
15			0.0				11.6	12.4	11.6	11.2	10.8	10.6

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
16						8.4	11.6	12.4	11.6	11.1	10.8	10.6
17					6.2	8.5	11.7	12.4	11.6	11.1	10.8	10.7
18						8.6	11.7	12.4	11.6	11.1	10.8	10.7
19						8.7	11.8	12.3	11.6	11.1	10.8	10.7
20						8.8	11.8	12.3	11.6	11.1	10.7	10.7
21						8.8	11.9	12.3	11.6	11.0	10.7	10.7
22						9.0	12.0	12.2	11.5	11.0	10.7	10.7
23						9.1	12.0	12.2	11.5	11.0	10.7	10.7
24						9.2	12.0	12.2	11.5	11.0	10.7	10.7
25						9.3	12.0	12.2	11.5	11.0	10.7	10.7
26						9.4	12.1	12.2	11.5	11.0	10.7	10.7
27						9.6	12.1	12.2	11.5	11.0	10.6	10.7
28						9.8	12.1	12.1	11.5	11.0	10.6	10.8
29						9.9	12.2	12.1	11.4	10.9	10.6	10.8
30						10.0	12.2	12.1	11.4	10.9	10.6	10.8
31					7.3		12.3	12.1		10.9		10.8
1907.												
1	10.8	11.0	11.3									
2	10.8	11.0	11.3									
3	10.8	11.0	11.3		13.0			13.7				
4	10.8	11.0	11.4	12.6								
5	10.8	11.0	11.4			13.8						
6	10.8	11.0	11.4	12.6								
7	10.8	11.0	11.4									
8	10.8	11.0	11.4									
9	10.8	11.0	11.4									
10	10.9	11.0			13.5			13.5	12.9		12.4	
11	10.9	11.0			13.5					12.4		
12	10.9	11.0				13.9						
13	10.9	11.1		12.9								
14	10.9	11.1						13.4	12.8			
15	10.9	11.1										
16	10.9	11.1	11.7									
17	10.9	11.1			13.6							
18	10.9	11.1			13.6							
19	10.9	11.2		13.0								
20	10.9	11.2								12.4		
21	10.9	11.2				14.0			12.6			
22	10.9	11.2										
23	10.9	11.2	12.0									
24	10.9	11.2										
25	10.9	11.2			13.7							
26	10.9	11.2										
27	10.9	11.2		13.0								
28	10.9	11.3										
29	11.0											
30	11.0		12.4				13.8					
31	11.0				13.8					12.4		
1908.												
1										8.6		
2												
3												
4								9.9				8.3
5												
6												
7										8.5		
8												
9												
10												
11						11.4						
12												
13					11.9							
14						11.2						
15												
16								9.6				
17												
18												
19												
20												

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21							10.4					
22												
23									8.6			
24												
25												
26												
27												
28												
29												
30						10.9						
31												

KERN RIVER DRAINAGE BASIN.

DESCRIPTION.

The Kern River basin, the largest and most southern of all the areas tributary to the San Joaquin Valley from the Sierra, also extends farther eastward than any of the other basins and differs from them in having its main axis north and south instead of east and west. It is long and comparatively narrow, and lies west of the main high Sierra divide, but it is east of the secondary parallel crest, called the Great Western Divide, which separates it from the basins of Kaweah and Tule rivers and southern foothill streams at the west. It is separated from Kings River basin at the north by a cross range about 15 miles in length, known as the Kings-Kern divide. To the east of this basin is the southern part of Owens Valley basin and the rough arid region south of Owens Lake and north of the Mohave Desert. The basin has a length of about 85 miles and a width of 25 to 30 miles. Its total drainage area above the valley rim is about 2,570 square miles.

Kern River has its source in numerous glacial lakes nestling in the shadow of many high peaks on the main Sierra divide, and on the Kings-Kern and the Great Western divides. A half dozen of these peaks exceed 14,000 feet in altitude, more than 50 exceed 13,000 feet, and many of the lakes are at an altitude of 11,000 feet or over. Mount Whitney, the highest mountain in the United States proper, has an altitude of 14,501 feet above sea level and overlooks the northern part of Kern basin from the east. The main stream flows directly southward for about 70 miles, then southwestward to the mouth of its canyon, a few miles northeast of Bakersfield, where it enters the southern end of the San Joaquin Valley. The total length of Kern River from its source to Bakersfield is about 140 miles.

The chief tributary of Kern River is South Fork. This stream heads in the main Sierra divide, 15 or 20 miles south of the headwaters of the main stream at an altitude of 11,000 feet, and flows

directly southward for about 50 miles, then westward about 20 miles, to its junction with the main stream at Isabella. Above the point of confluence the two streams have about equal lengths and drainage areas, and are parallel to each other and to the marginal rims. Each receives many short tributaries from the east and the west. The most important ones, however, Big Arroyo and Rattlesnake creeks and Little Kern River from the west, and Gold Trout Creek from the east, enter the main stream above North Fork.

Altitudes in the Kern River basin range from a few hundred feet at the mouth of the river's lower canyon to 14,000 feet and more at the north end. The basin is divided into two lesser basins by a medial axial ridge, which extends northward from the junction of South Fork with the main stream to an intersection with the Sierra divide near Trail Peak and about 12 miles south of Mount Whitney.

The topography of the two basins is very different. The eastern basin is characterized by comparatively low, flat, and irregular hills, separated by many intervening meadows, large and small; it is drained by South Fork. The western basin is characterized by high glaciated peaks and ridges and by deep canyons; it is drained by the main stream, which flows through a narrow canyon for a great part of its length. The Kern River canyon proper is about 20 miles long, 1 mile wide at the top, and 1,500 to 2,000 feet deep. It begins at Junction Meadow, 7 miles west of Mount Whitney, at an altitude of 8,500 feet, and runs due south to Kern Lake. The bottom of the canyon has a width of several hundred feet and an average gradient of 100 feet to the mile. The main canyon is intersected by short cross canyons, chiefly from the west. Above the junction of Kern River and South Fork the canyons broaden out into valleys of considerable size, especially on South Fork. Below the valleys, however, the main stream enters a rough canyon, which it follows to its entrance into the San Joaquin Valley. The formation is granitic.

The greater part of the Kern basin has a forest cover. In the foothills region the covering consists of grass and brush. Between altitudes of 3,000 and 10,000 feet there is a covering of timber and accompanying underbrush. The region above the 10,000-foot contour, however, is practically devoid of all timber growth. The entire basin is included in federal forest reserves.

The mean annual precipitation is light in the Kern basin. This is due in part to the fact that the basin is in the southern region of the Sierra, which receives less rainfall than the central and northern regions, and in part to the important fact that it lies east of the Great Western Divide, which intercepts the moisture-laden winds. The precipitation is undoubtedly heaviest in the northern part of the basin, which is surrounded by many high peaks that have snow

all the year, but no records exist as to the quantity. The central part of the basin probably has from 10 to 15 inches and the southern part less than 10 inches.

Some irrigation is done in the valleys about Kernville, particularly on the South Fork. Below the mouth of the lower canyon the total low-water flow is diverted for irrigation around Bakersfield in the San Joaquin Valley. Further development is undoubtedly possible by utilizing storage.

Many excellent reservoir sites exist on the South Fork, but the run-off is small. Reservoir sites also occur on some of the smaller tributaries of the main stream above South Fork.

As the fall of Kern River is very great and the minimum flow is furnished almost entirely from the higher altitudes, fine opportunities for power development are afforded. The minimum flow of the stream is capable of generating about 125,000 horsepower without storage. By utilizing the possible storage this amount could be increased to 200,000 horsepower.

The longest run-off record in this basin extends back to 1893. The wettest year since that time was 1906, and the driest 1898. The total flow during the wettest year was about seven and one-half times that during the driest.

The only gaging station maintained in this basin is on Kern River near Bakersfield, 1893 to 1908.

KERN RIVER NEAR BAKERSFIELD, CAL.

This station, which has been maintained by the Kern County Land Company to furnish a basis for the equitable division of the water of Kern River between different appropriators, is located at the mouth of the lower canyon, about 5 miles northeast of Bakersfield, at what is known as the "first point of measurement," in sec. 2, T. 29 S., R. 25 E. It was established September 29, 1893, by Walter James, chief engineer of the Kern County Land Company. The records furnish also statistical data regarding the run-off from a large area of the southern Sierra.

No tributaries enter below the station and only a few unimportant ones for 50 miles above.

Water diverted for power development above the station is returned to the river. Except for local irrigation in the valleys around Kernville no water is diverted for irrigation above the station. Below the point of measurement, however, the total flow of the river, except at flood stages, is diverted by the Kern County Land Company and the Miller & Lux interests, which own all the water rights on lower Kern River.

The stream flow records on Kern River are excellent. Regular current-meter measurements are made weekly, and an accurate cross-section is made from time to time with an engineer's level. An automatic water-stage register is used for obtaining gage heights.

The results are furnished to the Geological Survey by A. K. Warren, engineer in charge.

Daily discharge, in second-feet, of Kern River near Bakersfield, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1907.							1907.						
1	671	913	924	1,752	3,715	3,862	16	658	1,003	1,003	3,821	2,855	2,329
2	616	888	916	1,819	3,537	3,853	17	614	1,015	1,038	3,494	3,020	2,159
3	548	915	889	1,896	3,487	4,059	18	631	1,028	1,327	3,535	3,157	2,088
4	587	994	890	1,851	3,517	4,250	19	638	997	1,452	3,821	3,369	2,134
5	657	1,076	1,129	1,770	3,402	4,271	20	606	971	1,746	4,058	3,693	2,389
6	672	1,110	1,564	1,744	3,194	3,913	21	615	948	2,066	4,321	3,649	2,800
7	660	1,070	1,329	1,780	3,059	3,685	22	627	1,094	1,940	4,373	3,487	2,938
8	641	1,061	1,198	1,965	2,998	3,541	23	637	1,345	1,769	4,349	3,307	2,748
9	650	1,037	1,171	2,201	2,955	3,253	24	638	1,194	1,659	4,437	3,143	2,607
10	699	1,013	1,114	2,465	3,032	3,087	25	672	1,116	1,777	4,504	3,118	2,533
11	683	981	1,149	2,809	3,168	3,261	26	708	1,062	1,730	4,494	3,173	2,639
12	652	875	1,169	3,228	3,338	3,420	27	716	1,018	1,633	4,499	3,254	2,876
13	631	979	1,092	3,686	3,272	3,258	28	720	968	1,554	4,427	3,044	3,060
14	649	988	1,022	4,131	2,985	2,779	29	874	.....	1,522	4,235	3,123	3,123
15	642	995	998	4,263	2,818	2,523	30	1,045	.....	1,550	3,958	3,351	3,324
							31	966	.....	1,661	.....	3,590	.....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.										
1	851	964	2,015	1,200	825	593	284	378	340	310
2	777	921	2,080	1,119	826	632	272	359	325	313
3	762	903	2,003	1,069	830	656	309	362	318	316
4	745	886	1,765	1,003	838	761	303	354	317	327
5	732	898	1,576	912	829	832	296	353	314	335
6	761	922	1,442	918	852	1,077	285	350	306	338
7	761	958	1,427	941	852	908	286	341	299	348
8	719	1,002	1,477	953	836	827	308	327	296	336
9	716	998	1,348	1,022	806	723	343	306	291	307
10	754	1,004	1,244	1,116	786	672	411	299	291	295
11	706	1,054	1,198	1,162	763	666	371	284	299	287
12	719	1,278	1,163	1,211	763	632	422	279	302	279
13	752	1,418	1,160	1,239	852	576	524	297	311	249
14	801	1,592	1,154	1,245	862	551	458	304	324	334
15	865	1,606	1,120	1,233	796	503	406	313	338	294
16	1,068	1,565	1,112	1,191	739	477	410	317	343	299
17	1,242	1,454	1,058	1,132	657	454	387	334	325	301
18	1,367	1,421	1,032	1,079	582	433	371	396	297	290
19	1,386	1,450	1,002	1,003	494	396	344	427	279	272
20	1,362	1,550	1,011	934	555	379	320	413	270	264
21	1,356	1,625	1,002	895	593	367	306	391	265	269
22	1,407	1,635	974	910	545	371	294	374	287	291
23	1,442	1,611	1,012	878	530	359	285	361	291	298
24	1,454	1,467	1,099	847	494	357	330	360	313	285
25	1,493	1,396	1,100	859	475	340	330	373	328	278
26	1,576	1,418	1,286	876	468	319	453	376	314	283
27	1,475	1,485	1,294	901	464	307	511	366	293	290
28	1,321	1,639	1,198	886	474	298	501	369	296	236
29	1,219	1,850	1,161	853	506	302	449	363	306	288
30	1,158	2,023	1,237	817	602	283	402	358	304	290
31	1,064	.....	1,291	.....	604	272	.....	349	.....	292

Monthly discharge of Kern River near Bakersfield, Cal., for 1907 and 1908.

[Drainage area, 2,345 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.						
January	1,045	548	678	0.289	0.33	41,700
February	1,345	875	1,023	.436	.45	56,800
March	2,066	889	1,354	.577	.67	83,300
April	4,504	1,744	3,323	1.42	1.58	198,000
May	3,715	2,818	3,252	1.39	1.60	200,000
June	4,271	2,088	3,092	1.32	1.47	184,000
The period	4,504	548	2,120	.905	6.10	763,800
1908.						
March	1,576	706	1,058	.451	.52	65,100
April	2,023	886	1,333	.568	.63	79,300
May	2,080	1,002	1,292	.551	.64	79,400
June	1,245	817	1,013	.432	.48	60,300
July	862	464	681	.290	.33	41,900
August	1,077	272	527	.225	.26	32,400
September	524	272	366	.156	.17	21,800
October	427	279	349	.149	.17	21,500
November	343	265	306	.130	.14	18,200
December	348	249	298	.127	.15	18,300
The period	2,080	249	722	.257	3.49	438,200

NOTE.—No records of daily discharge were kept during the period from July, 1907, to February, 1908.

Mean monthly discharge, in second-feet, of Kern River near Bakersfield, Cal., from 1894 to 1906, inclusive.

[Furnished by the Kern County Land Company.]

Date.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	13-year monthly mean.
January	661	809	747	373	363	263	363	493	283	350	195	281	693	452
February	717	1,252	617	809	434	302	280	860	371	454	346	396	626	574
March	1,001	1,374	951	923	388	590	413	1,270	790	579	667	823	2,063	910
April	1,495	2,724	972	2,914	710	893	472	1,398	1,805	1,249	1,005	1,043	2,910	1,507
May	1,607	4,269	1,401	4,580	735	835	1,111	3,032	1,784	2,148	1,841	1,915	5,859	2,402
June	1,085	2,906	2,456	2,309	551	1,331	1,283	3,324	2,165	2,340	1,746	2,231	7,704	2,418
July	700	1,482	1,346	1,006	244	489	392	1,864	706	868	646	876	6,503	1,317
August	335	629	486	469	120	156	144	968	312	303	467	327	2,299	540
September	248	344	304	298	116	105	166	345	197	191	267	211	973	290
October	279	327	267	340	160	160	160	317	199	174	438	207	609	280
November	244	346	355	355	166	221	349	377	281	203	286	236	503	302
December	470	403	347	422	199	279	373	323	269	201	241	261	618	339
Yearly mean	737	1,413	854	1,234	348	468	459	1,216	763	755	679	735	2,625	945
Means to date, inclusive	737	1,075	1,001	1,059	917	838	788	841	832	825	811	805	945	

TULE RIVER DRAINAGE BASIN.

DESCRIPTION.

Tule River drains a small, somewhat rectangular area west of the Great Western Divide, which is a secondary crest of the Sierra lying parallel to and about 25 miles west of the main divide. The Tule

River basin is south of the Kaweah basin, west of the Kern basin, and north of the Deer Creek basin. Its length north and south averages about 25 miles, and its width averages about 15 miles. The total drainage area above the rim of the valley is about 370 square miles.

Tule River rises at an altitude of about 9,000 feet above sea level. The main stream is formed by the junction of North and Middle forks about 1 mile above Daunt post-office and about 15 miles northeast of Portersville. It takes a southwesterly course to the point where it leaves the foothills about 5 miles east of Portersville, and has a length of about 30 miles. South Fork joins the main stream about 8 miles below Daunt. The flood water passes westward through old channels in the river's alluvial fan to Tulare Lake, which it enters south of Corcoran.

Altitudes in the Tule basin range from 500 feet in the foothills to 10,000 feet along its eastern border. The western third is a typical foothill region with large, irregular hills of moderate altitude, separated by valleys. The eastern two-thirds is a typically eroded mountain region, which has a rather steep slope that has been characteristically carved by the action of primary and secondary stream systems. The formation is chiefly granitic.

The basin has a fairly good forest cover throughout. On the lower elevations the cover consists of grass, brush, and scattering timber; on the middle and higher elevations it is made up of good timber and accompanying underbrush. About two-thirds of the upper part of the basin is in a national forest.

The mean annual precipitation is about 8 inches in the valley below the foothills, 20 inches in the middle part of the basin, and 30 inches or more on the higher elevations where much of it occurs as snow.

Considerable irrigation is carried on in the small valleys above the point where the stream leaves the foothills. The total flow of the stream at moderate and low stages is diverted for irrigation in the vicinity of Portersville. Without storage further development is unlikely, but a small amount of storage is available.

The streams have plenty of fall, but the minimum flow is so small that only a few thousand horsepower could be developed continually without storage.

The longest run-off record in this basin extends back to 1901. The wettest year since that time was 1904, and the driest 1905, with 1908 a close second. The total flow during the wettest year was nearly five times that during the driest.

The only gaging station maintained in the basin is on Tule River near Portersville, 1901 to 1908.

TULE RIVER NEAR PORTERSVILLE, CAL.

This station, which is located 100 feet below the wagon bridge near McFarland's ranch, about 1 mile above the mouth of South Fork, and about 8 miles east of Portersville, was established April 8, 1901, to obtain general statistical information regarding the flow of Tule River. The data are valuable in connection with the reclamation of Tulare Lake and in planning future power and irrigation development.

South Fork unites with the main stream about 1 mile below the station. North and Middle forks join about 8 miles above.

A few small irrigation ditches divert water above the point of measurement. Below the station canals divert water for use chiefly in irrigating citrus fruits in the vicinity of Portersville. The acquired water rights exceed the minimum flow of the stream.

The gage datum has never been changed.

Conditions for obtaining discharge data are good. The channel is practically permanent and the velocity moderate. The records are thoroughly reliable.

Discharge measurements of Tule River near Portersville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 26	W. F. Martin	78	189	3.45	582
June 3	do	75	158	3.08	391
August 9	W. A. Lamb	60	40	1.25	44
September 27	do	55	30	1.13	29
November 10	do	57	47	1.37	56
1908.					
February 24	W. F. Martin	70	118	2.54	220
May 8	W. A. Lamb	67	102	2.20	164
June 20	W. F. Martin	59	51	1.48	66
August 29	W. V. Hardy	18	11	0.72	6.4

Daily gage height, in feet, of Tule River near Portersville, Cal., for 1907 and 1908.

[Adah McFarland and R. W. McFarland, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.3	3.1	2.4	3.0	3.0	2.9	2.1	1.3	1.15	1.15	1.55	1.4
2	1.95	3.0	2.4	6.0	2.9	2.9	2.15	1.3	1.2	1.15	1.55	1.4
3	1.9	3.0	2.4	5.1	2.85	2.9	2.1	1.3	1.15	1.2	1.5	1.4
4	1.9	2.95	2.4	4.0	2.8	3.0	2.0	1.25	1.15	1.2	1.5	1.4
5	2.7	2.85	2.6	3.9	2.8	2.9	2.0	1.25	1.15	1.2	1.45	1.4
6	2.25	2.7	2.6	3.8	2.8	2.9	1.9	1.25	1.1	1.2	1.4	2.0
7	2.25	2.6	2.7	3.8	2.75	2.85	1.9	1.25	1.1	1.2	1.4	2.9
8	2.65	2.6	2.9	3.85	2.75	2.8	1.85	1.25	1.1	1.2	1.35	2.0
9	2.25	2.55	2.7	3.85	2.7	2.75	1.8	1.25	1.1	1.15	1.35	1.9
10	2.2	2.5	2.9	3.8	2.7	2.7	1.75	1.25	1.1	1.2	1.35	1.9
11	2.2	2.45	2.8	3.8	2.7	2.8	1.7	1.2	1.1	1.2	1.35	2.3
12	2.2	2.4	2.85	3.8	2.75	2.9	1.6	1.2	1.1	1.2	1.35	2.0
13	2.6	2.35	2.7	3.8	2.8	2.8	1.5	1.2	1.1	1.2	1.35	1.9
14	2.2	2.35	2.75	3.8	2.85	2.7	1.5	1.2	1.1	1.2	1.35	1.7
15	3.2	2.3	2.7	4.3	2.9	2.6	1.5	1.2	1.1	1.2	1.35	1.7
16	2.7	2.3	2.6	4.0	2.9	2.55	1.5	1.2	1.1	1.25	1.35	1.9
17	3.4	2.5	2.6	3.85	2.9	2.55	1.5	1.2	1.15	1.25	1.35	1.7
18	2.7	2.3	2.6	3.7	2.85	2.5	1.5	1.2	1.15	1.25	1.35	1.7
19	2.2	2.25	2.65	3.7	3.0	2.5	1.5	1.2	1.15	1.3	1.35	1.7
20	2.1	2.2	2.6	3.8	3.2	2.45	1.5	1.2	1.15	1.35	1.35	1.6

Daily gage height, in feet, of Tule River near Portersville, Cal., in 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	2.15	2.2	2.7	3.75	3.1	2.45	1.5	1.2	1.15	1.3	1.35	1.65
22	2.15	3.85	2.65	3.7	3.0	2.4	1.5	1.2	1.1	1.3	1.35	1.65
23	2.15	3.2	2.7	3.65	2.9	2.35	1.45	1.2	1.1	1.35	1.35	1.7
24	2.15	2.8	4.8	3.6	2.95	2.35	1.45	1.15	1.1	1.4	1.35	1.75
25	2.2	2.8	3.6	3.5	2.9	2.3	1.4	1.15	1.1	1.4	1.35	1.75
26	2.2	2.8	3.5	3.4	2.9	2.25	1.4	1.15	1.1	1.5	1.35	1.8
27	2.2	2.7	3.35	3.4	2.9	2.2	1.4	1.15	1.1	1.6	1.35	1.8
28	2.35	2.45	3.2	3.3	2.8	2.15	1.4	1.15	1.15	1.6	1.35	2.0
29	3.2	.....	3.0	3.2	2.8	2.1	1.35	1.15	1.15	1.6	1.35	2.0
30	3.2	.....	3.0	3.1	2.9	2.1	1.35	1.15	1.15	1.55	1.35	1.9
31	3.2	.....	3.0	.....	2.9	.....	1.3	1.15	.....	1.55	.....	1.8
1908.												
1	1.75	1.8	3.1	2.15	2.3	2.0	1.2	.85	.75	1.05	1.15	1.3
2	1.7	2.6	3.0	2.1	2.3	1.95	1.2	.85	.7	1.0	1.15	1.3
3	1.65	3.1	3.0	2.1	2.3	1.95	1.15	.85	.75	1.05	1.15	1.3
4	1.75	2.6	3.0	2.1	2.25	1.95	1.1	.85	.7	1.05	1.15	1.3
5	1.7	2.2	3.5	2.1	2.25	1.9	1.1	.85	.8	1.05	1.15	1.4
6	1.6	1.9	3.1	2.1	2.2	1.85	1.1	.85	.8	1.05	1.15	1.35
7	1.7	1.85	2.7	2.1	2.2	1.85	1.05	.85	.85	1.0	1.15	1.3
8	1.7	1.85	2.4	2.1	2.2	1.8	1.05	.85	.85	1.0	1.15	1.3
9	1.7	3.5	2.3	2.1	2.15	1.8	1.05	.85	.9	1.0	1.15	1.3
10	1.6	3.1	2.35	2.1	2.1	1.75	1.0	.9	.9	1.0	1.1	1.3
11	1.6	2.7	2.4	2.1	2.1	1.7	1.0	.85	.9	1.0	1.1	1.3
12	1.6	2.4	2.5	2.25	2.4	1.7	1.0	.85	.9	1.0	1.1	1.3
13	1.7	2.2	2.6	2.35	2.35	1.65	1.0	.8	.9	1.0	1.1	1.3
14	1.75	2.1	2.65	2.35	2.3	1.65	.95	.8	.9	1.0	1.1	1.3
15	2.4	2.0	2.7	2.35	2.2	1.6	.95	.8	.95	1.0	1.1	1.3
16	2.2	2.0	3.1	2.3	2.15	1.6	.95	.8	.95	1.6	1.1	1.3
17	1.95	1.95	3.0	2.25	2.2	1.55	.95	.8	.95	1.5	1.1	1.35
18	1.9	1.95	2.95	2.25	2.2	1.55	.95	.8	.95	1.3	1.1	1.35
19	1.85	1.9	2.9	2.25	2.2	1.5	.9	.8	.95	1.3	1.1	1.3
20	1.85	1.9	2.8	2.2	2.2	1.5	.9	.8	.95	1.25	1.1	1.3
21	1.8	2.4	2.75	2.2	2.15	1.45	.9	.75	.95	1.2	1.1	1.3
22	1.8	4.6	2.7	2.4	2.1	1.45	.85	.75	.95	1.2	1.1	1.3
23	1.8	3.0	2.7	2.6	2.1	1.45	.85	.75	.95	1.2	1.2	1.3
24	2.5	2.55	2.65	2.3	2.05	1.4	.9	.8	1.1	1.2	1.6	1.3
25	2.7	2.55	2.6	2.3	2.1	1.4	.85	.8	1.4	1.15	1.35	1.3
26	2.25	2.6	2.6	2.3	2.1	1.4	.9	.75	1.2	1.15	1.3	1.3
27	2.0	2.6	2.5	2.3	2.05	1.35	.9	.75	1.15	1.15	1.3	1.3
28	1.95	2.6	2.4	2.35	2.0	1.3	.9	.7	1.1	1.15	1.25	1.3
29	1.9	3.2	2.3	2.4	2.05	1.2	.9	.8	1.1	1.15	1.25	1.3
30	1.85	.....	2.2	2.35	2.05	1.2	.9	.75	1.05	1.15	1.25	1.3
31	1.8	.....	2.2	.....	2.0	.....	.9	.75	.....	1.15	.....	1.3

Rating table for Tule River near Portersville, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	6	1.80	100	2.90	345	4.00	840
.80	10	1.90	115	3.00	380	4.20	960
.90	15	2.00	132	3.10	420	4.40	1,090
1.00	21	2.10	150	3.20	460	4.60	1,230
1.10	28	2.20	170	3.30	500	4.80	1,370
1.20	36	2.30	190	3.40	540	5.00	1,510
1.30	45	2.40	210	3.50	580	5.20	1,660
1.40	55	2.50	235	3.60	630	5.40	1,820
1.50	65	2.60	260	3.70	680	5.60	1,980
1.60	76	2.70	285	3.80	730	5.80	2,140
1.70	87	2.80	315	3.90	780	6.00	2,300

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 to 1908 and is well defined. Above gage height 1.8 feet it is the same as the 1906 table.

Monthly discharge of Tule River near Portersville, Cal., for 1907 and 1908.

[Drainage area, 266 square miles.] [a]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	540	115	232	0.872	1.00	14,300	A.
February	755	170	285	1.07	1.11	15,800	A.
March	1,370	210	354	1.33	1.53	21,800	A.
April	2,300	380	764	2.87	3.20	45,500	A.
May	460	285	338	1.27	1.46	20,800	A.
June	380	150	262	.985	1.10	15,600	A.
July	160	45	82.3	.309	.36	5,060	A.
August	45	32	36.7	.138	.16	2,260	A.
September	36	28	29.9	.112	.12	1,780	A.
October	76	32	46.0	.173	.20	2,830	A.
November	70	50	53.0	.199	.22	3,150	A.
December	345	55	106	.398	.46	6,520	A.
The year	2,300	28	216	.810	10.92	155,000	
1908.							
January	285	76	116	.436	.50	7,130	A.
February	1,230	100	264	.992	1.07	15,200	A.
March	580	170	296	1.11	1.28	18,200	A.
April	260	150	178	.669	.75	10,600	A.
May	210	132	164	.617	.71	10,100	A.
June	132	36	79.8	.300	.34	4,750	A.
July	36	12	20.0	.075	.09	1,230	A.
August	15	6	10.3	.039	.04	633	A.
September	55	6	18.5	.070	.08	1,100	A.
October	76	21	31.3	.118	.14	1,920	A.
November	76	28	34.1	.128	.14	2,030	A.
December	55	45	45.8	.172	.20	2,720	A.
The year	1,230	6	105	.394	5.34	75,600	

[a] Area revised since 1906 report.

KAWEAH RIVER DRAINAGE BASIN.

DESCRIPTION.

The Kaweah River basin lies on the western slope of the Sierra in the northern part of Tulare County, south and west of the Kings River basin, north of the Tule River basin, and west of the upper Kern River basin. In shape it roughly approximates a rectangular quadrilateral with sides about 26 miles in length. One corner is formed at the head of the alluvial delta fan below the foothills, and the opposite diagonal corner rests on Triple Divide Peak in the high Sierra, 15 or 20 miles west of the main crest. The east side of the quadrilateral rests on the Kaweah-Kern watershed, a secondary crest of the Sierra west of the main one and known as the Great Western Divide. The total area of the basin is about 715 square miles.

Kaweah River rises in numerous small lakes nestling among high peaks on or near the divide at an altitude of about 12,000 feet above sea level. The main stream is formed by the confluence of North, Middle, and South forks 10 or 15 miles above the head of its delta, and

its course is southwestward throughout its length. Below the foothills it divides into several distributaries which cross the delta fan and enter Tulare Lake near Corcoran. Its total length above the delta is about 45 miles.

The Kaweah basin has a varied rolling topography, ranging in altitude from a few hundred feet in the foothills to more than 12,000 feet at the eastern border. There are many domes and ridges in the upper parts of the basin interspersed between numerous upland meadows and glacial lakelets. Only a small part of the area is high enough to have perpetual snow. Most of the streams have fairly well developed canyons with moderately steep slopes. The formation is granitic.

The basin is fairly well forested. The lower foothills are covered with grass, brush, and scrubby timber. By far the greater part of the area, however, has an excellent cover of timber and underbrush. The Sequoia National Park, situated almost wholly in Kaweah basin, contains the largest grove of big trees (*Sequoia gigantea*) in the Sierra. Practically all the area outside of the park is included in a national forest.

The mean annual precipitation ranges from 10 inches in the valley to 20 inches on the lower elevations and probably 40 inches in the upper part. On probably one-half the area it occurs chiefly as snow.

The opportunities for irrigation in the Kaweah basin are practically restricted to the valley delta below the foothills. Virtually the total flow at moderate and low stages is now diverted for irrigating land in Tulare County; but little further development seems possible without storage, and for this opportunities are not very favorable.

Some reservoir sites, however, could be developed. One of these sites is about 2 miles below Three Rivers post-office. Considerable storage can be effected in the upper parts of the basin by throwing low dams across the outlets of the larger lakes.

Opportunities for water-power development are very good. The streams have comparatively heavy gradients and a minimum flow sufficiently large to generate about 30,000 horsepower without storage. For a period of at least six months in the year more than 100,000 horsepower could be obtained.

The longest run-off record extends back to 1903. The wettest year since that time was 1906 and the driest 1908. The total flow during the wettest year was about four and one-half times that during the driest.

The only gaging station maintained in the basin is on Kaweah River below Three Rivers, 1903 to 1908.

KAWEAH RIVER BELOW THREE RIVERS, CAL.

This station, which is located about 1½ miles below Three Rivers post-office and about one-fourth mile back of J. O. Carter's ranch house, on the wagon road from Lemon Cove to Three Rivers, was established April 29, 1903, to obtain general statistical information regarding the flow of Kaweah River. The data are valuable also in connection with the reclamation of Tulare Lake and in planning future irrigation and power development. The station is about three-fourths of a mile below the confluence of North, Middle, and South forks.

No important tributaries enter below the point of measurement.

Some water is diverted above the station for power, particularly on Middle and East forks, but it is returned to the stream above Three Rivers. A few very small ditches divert water for local irrigation and domestic uses in the small valleys above Three Rivers. The acquired water rights on this stream probably exceed the low-water flow.

The gage datum has never been changed. The conditions for obtaining accurate discharge data are fairly good. The stream is confined to its channel except at very high stages, when the right bank overflows somewhat. The bed, though composed of fine gravel and sand, is not subject to much change. The current is somewhat sluggish at very low stages and rather swift at high stages, though not excessively so. A fair degree of confidence can be placed in the records. The discharge curve for this station for 1906 to 1908 is shown in figure 1, p. 25.

Discharge measurements of Kaweah River below Three Rivers, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27	W. F. Martin	175	712	7.42	2,380
June 5	do	180	748	7.55	2,230
August 8	W. A. Lamb	150	414	5.53	395
September 26	do	145	281	4.60	67
November 9	do	148	288	4.77	106
1908.					
February 25	W. F. Martin	147	399	5.52	334
May 7	W. A. Lamb	163	570	6.48	978
June 19	W. F. Martin	155	443	5.89	505
August 27	W. V. Hardy	45	52	4.35	49

Daily gage height, in feet, of Kaweah River below Three Rivers, Cal., for 1907 and 1908.

[J. O. Carter, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.3	5.8	5.8	7.65	7.2	7.9	7.2	5.85	4.85	4.6	5.0	4.7
2	5.25	5.85	5.8	6.9	7.2	8.15	7.15	5.8	4.85	4.6	4.95	4.65
3	5.3	5.95	5.7	7.3	7.4	8.2	7.2	5.75	4.85	4.6	4.9	4.65
4	5.3	5.95	5.9	6.95	7.4	8.05	7.2	5.6	4.85	4.6	4.85	4.65
5	5.5	5.95	6.5	6.85	7.05	7.6	7.1	5.6	4.85	4.6	4.8	4.7
6	5.4	5.95	6.4	6.8	7.0	7.55	7.0	5.55	4.8	4.8	4.8	4.8
7	5.35	5.9	6.1	6.85	7.05	7.6	7.0	5.55	4.8	4.75	4.8	6.2
8	5.6	5.95	6.1	6.9	7.0	7.3	6.8	5.5	4.75	4.7	4.8	5.35
9	5.5	5.95	6.05	7.1	7.1	7.3	6.75	5.4	4.75	4.65	4.75	5.1
10	5.55	5.9	6.0	7.3	7.35	7.5	6.65	5.4	4.7	4.6	4.75	5.1
11	5.4	5.9	6.2	7.4	7.5	7.5	6.65	5.4	4.7	4.6	4.75	5.75
12	5.35	5.8	6.2	7.5	7.3	7.55	6.65	5.3	4.7	4.6	4.75	5.3
13	5.5	5.8	6.05	7.7	7.1	7.1	6.6	5.3	4.7	4.6	4.75	5.3
14	5.4	5.8	6.0	7.7	6.95	6.95	6.5	5.3	4.7	4.6	4.7	5.15
15	5.7	5.8	5.9	7.4	7.1	6.85	6.5	5.25	4.65	4.6	4.7	5.1
16	5.5	5.8	5.9	7.3	7.4	6.9	6.4	5.3	4.65	4.6	4.7	5.35
17	5.5	6.1	6.7	7.3	7.4	6.8	6.35	5.3	4.65	4.7	4.7	5.1
18	5.4	5.85	6.4	7.4	7.55	6.9	6.35	5.2	4.65	4.7	4.8	5.0
19	5.35	5.7	6.7	7.5	7.85	7.2	6.35	5.2	4.6	4.7	4.8	5.0
20	5.35	5.7	7.1	7.65	7.85	7.4	6.2	5.2	4.6	4.7	4.8	5.05
21	5.4	5.8	7.1	7.6	7.7	7.5	6.1	5.1	4.6	4.75	4.8	5.0
22	5.45	6.85	6.8	7.5	7.6	7.4	6.1	5.05	4.6	4.75	4.75	5.0
23	5.5	6.3	6.65	7.55	7.25	7.25	6.1	5.0	4.6	4.8	.....	4.95
24	5.5	6.1	7.45	7.5	7.15	7.15	6.15	5.0	4.6	5.0	.....	4.95
25	5.6	6.0	8.0	7.5	7.15	7.2	6.15	5.0	4.6	4.95	4.7	4.95
26	5.55	6.15	7.1	7.7	7.4	7.3	6.1	5.0	4.6	4.9	4.75	4.95
27	5.5	5.95	6.9	.....	7.2	7.4	6.0	5.0	4.6	5.35	4.7	5.1
28	7.15	5.9	6.7	7.3	7.4	7.4	6.0	4.95	4.6	5.3	4.7	5.2
29	6.75	.....	6.3	7.4	7.5	7.35	5.9	4.9	4.6	5.1	4.7	5.1
30	6.1	.....	6.65	7.3	7.65	7.3	5.8	4.9	4.6	5.0	4.7	5.1
31	5.95	.....	6.75	.....	7.9	.....	5.8	4.9	.....	5.15	.....	5.2
1908.												
1	5.15	5.15	5.75	5.7	7.1	6.1	5.5	5.3	4.3	4.55	4.5	4.65
2	5.1	5.1	5.7	5.65	6.85	6.1	5.5	5.3	4.3	4.5	4.55	4.7
3	5.0	5.55	5.6	5.65	6.8	6.0	5.45	5.2	4.3	4.5	4.5	4.8
4	5.05	5.9	5.5	5.65	6.5	5.85	5.45	4.95	4.3	4.5	4.55	4.75
5	5.0	5.4	5.5	5.8	6.35	5.85	5.4	4.9	4.3	4.5	4.55	4.9
6	5.0	5.35	5.6	5.9	6.4	5.8	5.3	4.8	4.3	4.5	4.5	4.8
7	5.0	5.3	5.5	5.8	6.5	5.95	5.3	4.8	4.4	4.5	4.5	4.75
8	5.0	5.25	5.6	5.7	6.65	6.2	5.3	4.7	4.55	4.45	4.5	4.75
9	5.0	5.45	5.6	5.75	6.2	6.2	5.2	4.7	4.5	4.45	4.5	4.7
10	5.0	5.45	5.65	5.9	6.0	6.3	5.25	4.65	4.45	4.4	4.5	4.7
11	5.0	5.35	5.7	6.2	6.0	6.3	5.2	4.6	4.7	4.4	4.5	4.7
12	5.0	5.4	5.75	6.3	6.15	6.3	5.2	4.6	4.6	4.4	4.5	4.65
13	5.0	5.2	5.85	6.4	6.05	6.3	5.2	4.6	4.5	4.4	4.5	4.65
14	5.1	5.3	6.0	6.4	6.0	6.2	5.1	4.5	4.5	4.4	4.5	4.65
15	5.45	5.35	6.1	6.3	6.0	6.15	5.1	4.5	4.4	4.6	4.5	4.65
16	5.25	5.35	6.35	6.25	6.0	6.1	5.0	4.5	4.4	5.35	4.5	4.65
17	5.2	5.4	6.4	6.25	5.95	6.0	4.95	4.5	4.4	5.1	4.5	4.6
18	5.1	5.25	6.3	6.35	6.1	5.9	4.9	4.5	4.4	5.55	4.45	4.55
19	5.1	5.3	6.3	6.45	6.25	5.9	4.9	4.4	4.4	5.2	4.45	4.6
20	5.1	5.25	6.3	6.5	6.1	5.9	4.85	4.4	4.4	4.8	4.45	4.6
21	5.1	5.35	6.3	6.55	6.25	5.85	4.8	4.4	4.4	4.75	4.45	4.65
22	5.05	5.9	6.3	6.35	6.2	5.8	4.75	4.4	4.4	4.65	4.5	4.6
23	5.05	5.5	6.3	6.25	6.3	5.75	4.75	4.4	4.4	4.8	4.7	4.6
24	5.55	5.45	6.25	6.2	6.4	5.8	4.8	4.4	5.25	4.8	4.9	4.6
25	5.65	5.5	6.3	6.2	6.65	5.7	4.8	4.35	5.65	4.8	4.8	4.6
26	5.45	5.65	6.2	6.45	6.6	5.7	4.8	4.35	5.0	4.7	4.8	4.6
27	5.3	5.65	6.0	6.55	6.45	5.7	4.8	4.35	5.0	4.7	4.7	4.6
28	5.25	5.7	5.9	6.85	6.4	5.7	4.8	4.35	4.7	4.7	4.7	4.6
29	5.25	6.1	5.8	6.9	6.5	5.6	4.8	4.35	4.6	4.65	4.65	4.6
30	5.2	.....	5.75	6.9	6.6	5.5	4.8	4.35	4.6	4.6	4.65	4.6
31	5.15	.....	5.65	.....	6.2	.....	4.8	4.35	.....	4.6	.....	4.6

Rating table for Kaweah River below Three Rivers, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	35	5.70	446	7.20	1,730	8.70	4,470
4.30	42	5.80	503	7.30	1,870	8.80	4,700
4.40	51	5.90	564	7.40	2,010	8.90	4,930
4.50	62	6.00	628	7.50	2,160	9.00	5,160
4.60	75	6.10	695	7.60	2,320	9.10	5,400
4.70	91	6.20	765	7.70	2,480	9.20	5,640
4.80	110	6.30	839	7.80	2,650	9.30	5,880
4.90	132	6.40	917	7.90	2,830	9.40	6,120
5.00	156	6.50	999	8.00	3,010	9.50	6,370
5.10	184	6.60	1,085	8.10	3,200	9.60	6,620
5.20	216	6.70	1,175	8.20	3,400	9.70	6,870
5.30	254	6.80	1,270	8.30	3,600	9.80	7,130
5.40	296	6.90	1,370	8.40	3,810	9.90	7,390
5.50	342	7.00	1,480	8.50	4,030	10.00	7,650
5.60	392	7.10	1,600	8.60	4,250		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made 1903 to 1908 and is well defined.

Monthly discharge of Kaweah River below Three Rivers, Cal., for 1907 and 1908.

[Drainage area, 520 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,660	235	412	0.792	0.91	25,300	B.
February	1,320	446	600	1.15	1.20	33,300	B.
March	3,010	446	1,030	1.98	2.28	63,300	A.
April	2,480	1,270	1,960	3.77	4.21	117,000	A.
May	2,830	1,420	1,950	3.75	4.32	120,000	A.
June	3,400	1,270	2,030	3.90	4.35	121,000	A.
July	1,730	503	1,020	1.96	2.26	62,700	A.
August	533	132	261	.502	.58	16,000	B.
September	121	75	904	.174	.19	5,380	B.
October	275	75	112	.215	.25	6,890	B.
November	156	91	105	.202	.23	6,250	B.
December	765	83	197	.379	.44	12,100	B.
The year	3,400	75	814	1.56	21.22	589,000	
1908.							
January	419	156	206	.396	.46	12,700	B.
February	695	184	326	.627	.68	18,800	B.
March	917	342	598	1.15	1.33	36,800	B.
April	1,370	419	793	1.52	1.70	47,200	B.
May	1,600	596	886	1.70	1.96	54,500	B.
June	839	342	604	1.16	1.29	35,900	B.
July	342	100	185	.356	.41	11,400	B.
August	254	46	85.4	.164	.19	5,250	B.
September	419	42	81.5	.157	.18	4,850	B.
October	367	51	98.5	.189	.22	6,060	B.
November	132	56	71.6	.138	.15	4,260	B.
December	132	68	85.2	.164	.19	5,240	B.
The year	1,600	42	335	.643	8.76	243,000	

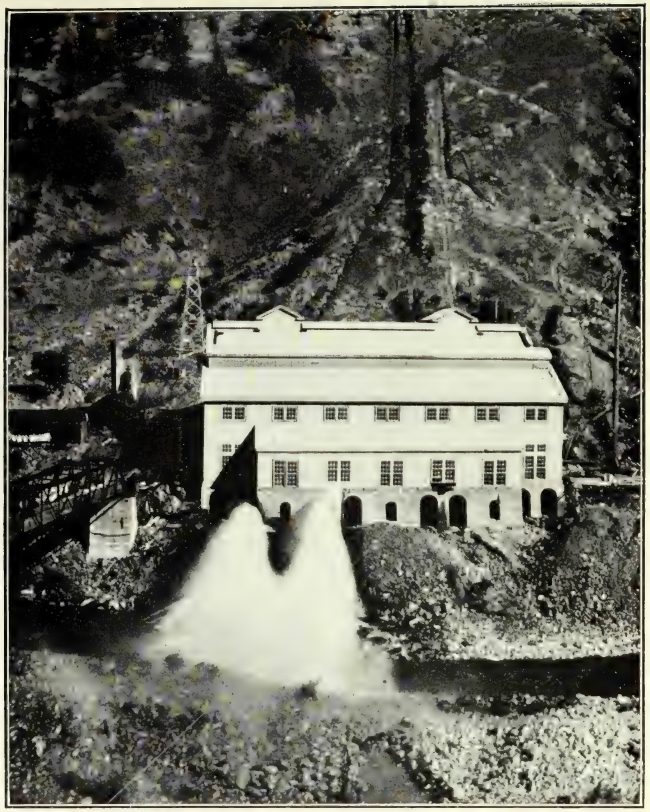
KINGS RIVER DRAINAGE BASIN.

DESCRIPTION.

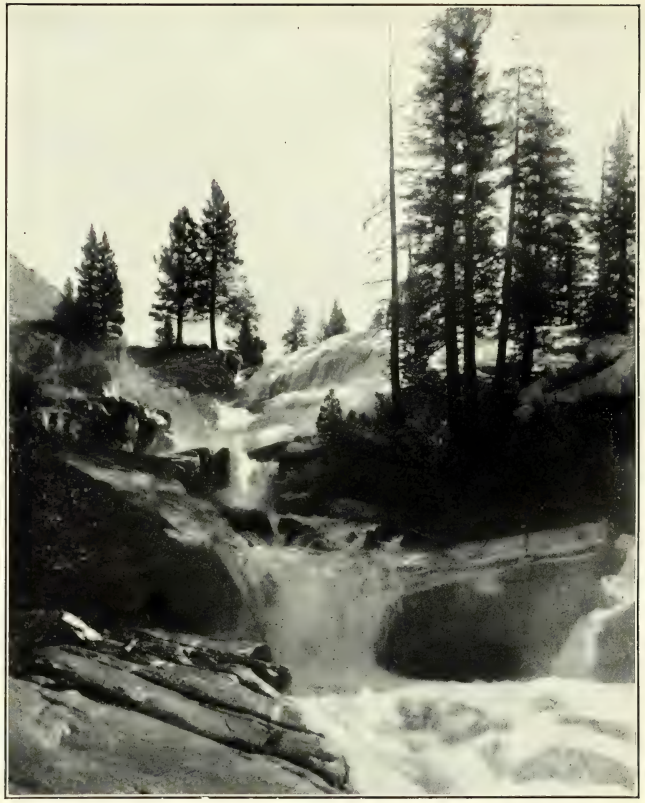
The Kings River basin lies on the western slope of the Sierra, south of the upper San Joaquin basin, and north of the Kaweah and upper Kern basins. For a distance of about 50 miles it touches the Sierra divide, which separates it from the central part of the Owens River basin at the east and contains many of the highest peaks in the Sierra. In shape and extent this basin is very much like the upper San Joaquin basin, which adjoins it at the north. It is roughly trapezoidal in shape, having a length of about 60 miles from valley rim to mountain crest, and ranging in width from about 15 miles at the west to about 45 miles at the east. Its total area above the valley border is about 1,840 square miles.

Kings River has its source in numerous glacial lakelets nestling at the foot of glaciers and perpetual snow banks which protrude from the summits of high peaks on and near the Sierra crest. The main stream is formed by the confluence of North, Middle, and South forks well up in the mountains. It takes a southwestward course to the mouth of its canyon, about 10 miles northeast of Sanger, whence it continues the same course across its delta fan to the trough of San Joaquin Valley about 6 miles west of Lemoore. From this point most of the low-water flow passes northwestward through Kings Slough to San Joaquin River about 3 miles north of Mendota, but most of the flood flow passes southward to Tulare Lake. The total length of the river from its source to the mouth of its canyon is about 85 miles. Besides the three forks and their tributaries, the other principal tributaries are Dinkey and Big creeks, from the north, and Mill Creek from the south.

The topography of the Kings River basin is very rough and irregular. At the head of this basin is the most rugged region in the Sierra. Many of the peaks are perpetually snow-capped; many others are sharp, bare, and precipitous. Altogether they produce some of the sublimest mountain scenery in the United States. Throughout the upper part of the basin there are, also, many charming lakes and beautiful meadows surrounded by lone peaks and domes. Nearly all the tributaries run through deep canyons cut through solid granite. The canyons of the three forks and of the main stream below their junction are long and narrow and 2,000 or 3,000 feet in depth. In some places they broaden out into narrow valleys with precipitous walls, like Kings River Canyon Valley on South Fork and Tehipite Valley on Middle Fork, which rival the famous Yosemite Valley in scenic grandeur. Altitudes in the basin range from 200 or 300 feet in the foothills to more than 14,000 feet at the eastern border. The formation is granitic.



A. POWER HOUSE OF THE STANISLAUS ELECTRIC POWER COMPANY, STANISLAUS RIVER.



B. FALLS ON BUBBS CREEK, TRIBUTARY TO KINGS RIVER.

The greater part of the Kings River basin is well forested. Above the 10,000-foot contour vegetation is very scanty; below this contour, however, there is a heavy covering of timber and underbrush. Extensive groves of big trees occur at many places in this basin. On the lower foothills the forest covering consists of brush, grass, and scattering small timber. Almost the entire basin above the valley rim lies in a national forest.

The mean annual precipitation varies with altitude. In the San Joaquin Valley it is 8 to 10 inches; in the foothills 20 to 30 inches; and on the higher elevations 50 to 60 inches. A large part of the basin has a high altitude and receives nearly all its precipitation in the form of snow, which never entirely disappears from the highest peaks.

Kings River offers magnificent opportunities for irrigation. Numerous canals, with a combined capacity of from 4,000 to 5,000 second-feet, now divert water from the river below the mouth of the canyon for use on the valley lands in Fresno, Kings, and Tulare counties, where the soil and climate are especially adapted to the raising of grapes and other fruits. During low water these canals take the total flow of the river.

Only a few storage reservoirs of much value exist in the Kings River basin. Several reservoir sites on the main stream and its tributaries have been surveyed and their availibility determined.[a]

A great deal of power could be developed in Kings River basin. The streams have very heavy gradients, and the minimum flow is sufficient to generate at least 125,000 horsepower without storage. This amount could be easily doubled by utilizing the potential storage. Middle and South forks afford the greatest opportunities for power. (See Pl. V, *B*.)

The longest run-off record in this basin extends back to 1895. The wettest year since that time was 1906, and the driest, 1898. The total flow of the wettest year was about five times that of the driest.

The only gaging station maintained in this basin is on Kings River near Sanger, 1895 to 1908.

KINGS RIVER NEAR SANGER, CAL.

This station, which is located just below a big bend in the river near the mouth of the canyon, about 15 miles northeast of Sanger and southwest of Red Mountain, was established September 3, 1895, to obtain general statistical data regarding the flow of Kings River. The data are useful also in considering irrigation, power, and storage developments, and in studying the flood and reclamation problems of Tulare Lake and lower San Joaquin River.

---

[a] See Water-Supply Paper U. S. Geol. Survey No. 58.

No tributaries enter below the station. Mill Creek enters from the south about 3 miles above the point of measurement. Big and Dinkey creeks enter from the north about 10 and 15 miles, respectively, above the station. The junction of the forks is 20 or 25 miles above.

No diversions are made immediately above the place of measurement. Many miles above, however, a small quantity of water is diverted from tributary streams into a flume used for transporting lumber from the mountains to Sanger. The total flow of the river at low and moderate stages is diverted into irrigation canals only a short distance below the station. The acquired water rights greatly exceed the low-water flow.

An automatic water-stage register is used for obtaining gage heights at this station because of the remarkable diurnal fluctuations of stage, especially during the spring and early summer when the snow is melting rapidly. It is not an unusaul thing to remove a weekly record sheet that has a notably regular sinusoidal curve traced across it, showing an hourly change and a daily range of nearly two feet. No change has ever been made in the gage datum.

The conditions for obtaining accurate discharge data at this station are very good. The stream is confined to its channel at all stages and the current is never too sluggish nor too swift. The channel has a gravel bottom, but there is very little change in it. This stream is well rated every year, so that full reliance can be placed in the records.

Discharge measurements of Kings River near Sanger, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	W. F. Martin	304	1,700	9.76	8,400
June 4	do	328	2,450	11.95	15,300
August 7	W. A. Lamb	230	944	7.22	2,870
August 31	do	165	508	5.30	794
September 25	do	140	372	4.75	382
November 8	do	140	356	4.70	384
1908.					
February 26	W. F. Martin	163	538	5.45	1,040
February 29	do	210	795	6.75	2,300
May 6	W. A. Lamb	293	1,230	8.09	4,350
June 18	W. F. Martin	210	819	7.05	2,520
August 25	W. V. Hardy	135	382	4.82	526
September 1	do	120	334	4.63	383
October 19	do	120	343	4.73	416
December 5	W. F. Martin	138	347	4.67	412

Daily gage height, in feet, of Kings River near Sanger, Cal., for 1907 and 1908.

[O. G. Williams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.5	6.15	6.0	8.15	9.5	11.75	10.8	7.85	5.3	4.7	4.95	4.55
2	5.25	6.2	5.95	8.6	9.6	11.9	10.55	8.0	5.25	4.65	4.9	4.5
3	5.15	6.4	6.0	8.25	9.9	12.05	10.7	8.05	5.15	4.65	4.85	4.5
4	5.3	6.3	6.15	7.85	9.9	12.05	11.15	7.65	5.15	4.65	4.85	4.5
5	5.6	6.5	6.95	7.65	9.2	10.4	10.9	7.35	5.2	4.6	4.8	4.5
6	5.45	6.35	7.75	7.55	9.05	10.95	10.55	7.25	5.2	4.7	4.75	4.65
7	5.35	6.3	7.1	7.65	9.15	10.65	10.55	6.95	5.15	4.8	4.75	5.55
8	6.0	6.3	6.9	7.95	9.15	10.05	10.25	6.9	5.15	4.8	4.75	5.4
9	5.7	6.25	6.7	8.25	9.45	9.95	9.95	6.75	5.1	4.8	4.7	4.95
10	5.85	6.2	6.65	8.60	9.9	10.5	9.75	6.65	5.1	4.75	4.7	4.9
11	5.55	6.2	7.45	8.95	10.15	10.9	9.7	6.45	5.1	4.75	4.7	5.5
12	5.35	6.1	7.1	9.4	9.65	10.5	9.7	6.3	5.15	4.75	4.65	5.1
13	5.7	6.05	6.75	9.85	9.05	9.7	9.9	6.2	5.15	4.7	4.65	5.05
14	5.75	6.05	6.55	10.1	8.95	9.2	9.7	6.2	5.1	4.65	4.65	5.0
15	6.75	6.0	6.45	9.6	9.8	8.85	9.6	6.3	5.1	4.65	4.65	4.9
16	5.85	6.1	6.4	9.15	10.15	8.55	9.25	6.5	5.0	4.65	4.65	4.95
17	5.85	6.5	8.65	9.2	10.15	8.55	9.15	6.65	4.95	4.75	4.6	4.9
18	5.85	6.2	8.25	9.5	10.7	8.95	9.15	6.65	4.9	4.8	4.7	4.85
19	5.55	6.0	8.55	9.75	11.2	9.7	9.2	6.5	4.9	4.8	4.65	4.8
20	5.55	5.9	10.1	9.85	11.15	10.5	9.0	6.25	4.85	4.8	4.65	4.85
21	5.6	6.0	10.3	9.95	11.0	10.95	8.75	6.25	4.8	4.8	4.65	4.75
22	5.65	8.05	9.75	9.95	10.75	10.75	8.45	6.15	4.75	4.8	4.65	4.75
23	5.65	7.1	8.7	10.05	9.9	10.3	8.45	6.0	4.75	4.8	4.6	4.75
24	5.65	6.65	10.0	10.15	9.75	10.15	8.7	5.75	4.7	4.85	4.6	4.75
25	5.75	6.5	10.3	10.15	10.0	10.2	8.85	5.65	4.7	4.9	4.6	4.75
26	5.75	6.5	8.95	10.20	10.35	10.6	8.85	5.6	4.7	4.85	4.6	4.75
27	5.6	6.3	8.2	10.25	10.3	10.85	8.6	5.6	4.7	5.1	4.6	4.85
28	8.15	6.1	7.8	10.05	10.45	11.0	8.2	5.55	4.7	5.2	4.55	5.1
29	8.1	.....	7.55	9.85	10.8	11.2	8.25	5.45	4.65	5.05	4.55	5.1
30	6.8	.....	7.75	9.65	11.15	11.25	7.8	5.4	4.7	5.0	4.55	5.0
31	6.4	.....	8.05	.....	11.55	.....	7.55	5.35	.....	5.05	.....	5.05
1908.												
1	5.05	5.0	5.9	5.9	9.25	7.25	6.4	6.4	4.6	4.8	4.55	4.5
2	4.95	5.0	5.9	5.85	9.05	7.15	6.45	7.15	4.6	4.75	4.5	4.5
3	4.95	5.3	5.65	5.85	8.2	6.85	6.5	7.65	4.6	4.7	4.5	4.65
4	4.95	5.8	5.55	5.9	7.7	6.6	6.55	6.75	4.6	4.65	4.5	4.65
5	4.9	5.35	.....	5.9	7.6	6.6	6.6	6.8	4.6	4.65	4.5	4.7
6	4.85	5.2	.....	6.0	7.9	6.65	6.6	6.4	4.65	4.65	4.5	4.75
7	4.85	5.1	5.5	6.15	8.25	6.75	6.55	6.15	4.7	4.65	4.5	4.65
8	4.85	5.1	5.45	6.05	7.8	7.15	6.45	5.85	4.85	4.6	4.45	4.6
9	4.85	5.4	5.45	6.1	7.35	7.4	6.3	5.8	5.0	4.55	4.45	4.6
10	4.85	5.55	5.5	6.15	7.0	7.55	6.2	5.8	4.85	4.55	4.45	4.6
11	4.85	5.3	5.55	6.5	6.95	7.75	6.15	5.7	5.15	4.5	4.45	4.55
12	4.85	5.2	5.65	7.25	7.0	7.85	6.2	5.55	5.3	4.5	4.45	4.5
13	4.9	5.15	5.75	7.7	6.85	7.9	6.3	5.4	5.1	4.5	4.45	4.45
14	5.0	5.2	6.0	7.95	6.75	7.85	6.2	5.3	4.95	4.45	4.4	4.45
15	5.15	5.15	6.25	7.65	6.9	7.6	6.0	5.2	4.85	4.45	4.4	4.5
16	5.0	5.1	6.65	7.55	6.85	7.55	5.85	5.1	4.75	4.7	4.4	4.45
17	5.0	5.15	6.8	7.3	6.65	7.3	5.65	5.05	4.75	4.85	4.4	4.45
18	5.0	5.1	6.75	7.6	6.7	7.0	5.6	5.0	4.75	4.85	4.4	4.45
19	4.95	5.05	6.85	8.15	7.0	6.85	5.7	4.95	4.7	4.75	4.4	4.4
20	4.9	5.1	6.85	8.25	6.95	6.6	5.7	4.95	4.7	4.75	4.4	4.4
21	4.9	5.1	6.9	8.3	7.05	6.8	5.65	4.95	4.65	4.7	4.35	4.45
22	4.9	5.2	6.8	7.85	7.2	6.75	5.65	4.95	4.65	4.7	4.4	4.45
23	4.9	5.25	6.8	7.5	7.6	6.6	5.65	4.85	4.6	4.7	4.5	4.45
24	5.45	5.15	6.8	7.3	8.05	6.65	5.65	4.85	4.9	4.7	4.65	4.4
25	5.8	5.2	6.9	7.4	8.4	6.75	5.55	4.8	5.55	4.7	4.6	4.4
26	5.6	5.4	6.8	7.85	8.25	6.8	5.5	4.8	5.6	4.7	4.6	4.4
27	5.3	.....	6.45	8.35	7.95	6.75	5.5	4.75	5.3	4.7	4.6	4.4
28	5.2	.....	6.2	8.95	7.85	6.6	5.65	4.75	5.15	4.65	4.5	4.4
29	5.15	6.9	6.15	9.2	8.25	6.55	5.7	4.7	5.0	4.65	4.5	4.4
30	5.1	.....	6.05	9.2	8.3	6.4	5.7	4.7	4.85	4.65	4.5	4.4
31	5.05	.....	5.9	.....	7.7	.....	5.7	4.65	.....	4.6	.....	4.4

Rating tables for Kings River near Sanger, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	265	5.90	1,300	7.30	2,950	9.40	7,300
4.60	315	6.00	1,390	7.40	3,110	9.60	7,830
4.70	370	6.10	1,480	7.50	3,270	9.80	8,380
4.80	430	6.20	1,570	7.60	3,430	10.00	8,940
4.90	495	6.30	1,670	7.70	3,600	10.20	9,510
5.00	565	6.40	1,770	7.80	3,770	10.40	10,110
5.10	640	6.50	1,880	7.90	3,950	10.60	10,710
5.20	720	6.60	1,990	8.00	4,140	10.80	11,330
5.30	800	6.70	2,110	8.20	4,540	11.00	11,980
5.40	880	6.80	2,230	8.40	4,960	11.40	13,310
5.50	960	6.90	2,360	8.60	5,400	12.00	15,400
5.60	1,040	7.00	2,500	8.80	5,840		
5.70	1,120	7.10	2,650	9.00	6,300		
5.80	1,210	7.20	2,800	9.20	6,790		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous measurements, and is well defined.

FOR 1908.

4.30	250	5.40	920	6.50	2,000	7.60	3,450
4.40	280	5.50	1,000	6.60	2,110	7.70	3,610
4.50	320	5.60	1,090	6.70	2,230	7.80	3,780
4.60	370	5.70	1,180	6.80	2,350	7.90	3,960
4.70	430	5.80	1,280	6.90	2,480	8.00	4,150
4.80	490	5.90	1,380	7.00	2,610	8.20	4,540
4.90	550	6.00	1,480	7.10	2,740	8.40	4,960
5.00	620	6.10	1,580	7.20	2,880	8.60	5,400
5.10	690	6.20	1,680	7.30	3,020	8.80	5,840
5.20	760	6.30	1,780	7.40	3,160	9.00	6,500
5.30	840	6.40	1,890	7.50	3,300	9.20	6,790

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1908 and is well defined.

Monthly discharge of Kings River near Sanger, Cal., for 1907 and 1908.

[Drainage area, 1,740 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	4,440	680	1,360	0.782	0.90	83,600	A.
February	4,240	1,300	1,740	1.00	1.04	96,600	A.
March	9,810	1,340	4,110	2.36	2.72	253,000	A.
April	9,660	3,350	7,000	4.02	4.48	417,000	A.
May	13,800	6,180	9,200	5.29	6.10	566,000	A.
June	15,600	5,290	10,400	5.98	6.67	619,000	A.
July	12,500	3,350	7,560	4.34	5.00	465,000	A.
August	4,240	840	1,970	1.13	1.30	121,000	A.
September	800	342	554	.318	.35	33,000	A.
October	720	315	435	.250	.29	26,700	A.
November	530	290	363	.209	.23	21,600	A.
December	1,000	265	502	.289	.33	30,900	A.
The year	15,600	265	5,770	2.16	29.41	2,730,000	

Monthly discharge of Kings River near Sanger, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,280	520	650	0.374	0.43	40,000	A.
February	2,480	620	897	.516	.56	51,600	A.
March	2,480	960	1,670	.960	1.11	103,000	A.
April	6,790	1,330	3,210	1.84	2.05	191,000	A.
May	6,920	2,170	3,580	2.06	2.38	220,000	A.
June	3,960	1,890	2,680	1.54	1.72	159,000	A.
July	2,110	1,000	1,480	.851	.98	91,000	A.
August	3,530	400	1,080	.621	.72	66,400	A.
September	1,090	370	550	.316	.35	32,700	A.
October	520	300	405	.233	.27	24,900	A.
November	400	265	312	.179	.20	18,600	A.
December	460	280	323	.186	.21	19,900	A.
The year	6,920	265	1,400	.806	10.98	1,020,000	

MERCED RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Merced River lies on the western slope of the Sierra, north of the upper San Joaquin basin and south of the Tuolumne basin. It does not extend so far eastward as the other two basins, and it touches the Sierra divide in only one point—Mount Lyell (elevation, 13,090 feet)—which is common to the three basins. The mountainous part of the basin lies almost wholly in Mariposa County; the foothill and valley parts are in Merced County. The basin is somewhat rectangular in shape. It has a length of about 65 miles from the rim of the valley to the crest and a width of 20 to 25 miles. The total area of the basin above the valley border is about 1,200 square miles.

Merced River has its source in numerous small glacial lakes in the region about Mount Lyell and flows southwestward to its junction with the lower San Joaquin, about 5 miles northeast of Newman. It has a total length of about 135 miles, two-thirds of which is in the mountains. Its chief tributaries are Tenaya and Yosemite creeks from the north and Illilouette and Bridal Veil creeks and South Fork from the south.

The formation in this basin is chiefly granitic. The topography is very rough and much broken in the upper parts. The altitude ranges from a few hundred feet in the foothills to 13,000 feet around Mount Lyell. Within this basin is the famous Yosemite Valley, with its precipitous walls, bare granitic domes, and waterfalls of prodigious height. This valley, which averages less than a mile wide and is about 7 miles long, is a gorge cut chiefly by glacial action. From its floor the marginal cliffs rise almost vertically

2,000 to 3,000 feet, over which hung-up streams leap to the lower level as magnificent falls. The country around the valley rim is a rolling, glaciated region from 3,000 to 8,000 feet higher than the floor of the valley, which has an altitude of 4,000 feet. The valley opens westward into Merced Canyon.

The upper reaches of the basin above Yosemite Valley are largely devoid of forests, but the middle reaches are timbered. The growth extends well down on the lower elevations to the foothills, which are covered by scattering timber, brush, and grass. The Mariposa grove of big trees is situated in the South Fork basin. All the upper part of the basin, amounting to about 850 square miles, is included in national forest reserves.

The mean annual precipitation varies with altitude. It is from 10 to 15 inches in the San Joaquin Valley, about 25 inches in the foothills, and probably 60 inches on the higher elevations. It occurs almost entirely during the "rainy season." The snowfall is heavy during the winter and early spring and melts most rapidly in May and June, when, except on the higher peaks, the greater part of it disappears. The melting snow produces a regular annual rise in late spring and early summer. It is during this period that the splendid falls in Yosemite Valley attain their greatest beauty.

Opportunities for irrigation development are practically limited to the bottom lands in the foothills and parts of the San Joaquin Valley below. Present development utilizes almost the entire late summer flow of Merced River.

Considerable storage is feasible in the Merced basin above Yosemite Valley. Most of the reservoirs, however, would be very small.

Opportunities for power development are good. The minimum flow is small, but the fall is great. Without storage the minimum flow is sufficient to develop about 40,000 horsepower; with storage this amount could be increased to about 160,000 horsepower continuously.

The longest run-off record in the Merced basin extends back to 1901. The wettest year since that time was 1907 and the driest 1908. The total flow during the wettest year was more than four times that of the driest.

The following gaging stations have been maintained in the basin:

Merced River in Yosemite Valley (1904 to 1908).
Merced River above Merced Falls (1901 to 1908).
Tenaya Creek in Yosemite Valley (1904 to 1908).
Yosemite Creek in Yosemite Valley (1904 to 1908).

MERCED RIVER IN YOSEMITE VALLEY, CAL.

This station, which is located at the wagon bridge near the Sentinel Hotel, was established July 11, 1904, and has been maintained during only the summer season of each year to obtain data for comparing the

flow over Vernal and Nevada falls, by means of which Merced River enters Yosemite Valley.

Tenaya Creek enters from the north about 1 mile and Illilouette Creek from the south about 2 miles above the station. Yosemite Creek enters from the north about one-half mile and Bridal Veil Creek from the south about 3 miles below the station.

No diversions are made above the station except for the small hydro-electric plant which supplies the valley with light and power. The diverted water returns to the river above the station.

No change has been made in the gage datum. The channel is straight and not subject to much change. The current is sluggish. A fair degree of confidence can be placed in the results at this station.

Discharge measurements of Merced River in Yosemite Valley in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	W. B. Clapp	95	668	6.80	1,760
November 8	C. W. Tucker	89	286	3.30	50
1907.					
May 1	C. W. Tucker	92	604	6.85	1,790
May 19	do	89	833	8.85	3,120
May 23	Martin and Tucker	93	707	6.90	1,820
May 25	W. F. Martin	93	735	7.34	2,200
May 31	C. W. Tucker	95	913	9.00	3,610
June 24	do	95	724	7.50	2,020
July 29	do	95	621	6.50	1,460
August 23	do	95	433	4.40	365
1908.					
August 4	Tucker and Hardy	94	427	4.20	336
August 16	W. V. Hardy	55	128	3.50	123
September 30	C. W. Tucker	53	114	3.20	49

Daily gage height, in feet, of Merced River in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.6				6.9	8.8	8.6	6.3	3.9			
2					7.0	9.0	8.7	6.2	3.9			
3	3.6	4.1			7.2	9.1	8.6	6.1	3.9			
4			3.9		6.9	9.0	8.8	6.0	3.9			
5					6.7	8.6	9.0	5.8	3.9			
6			4.2		6.6	8.1	8.9	5.6	3.9		3.5	
7		4.2	4.1		6.8	7.7	8.8	5.4	3.9	3.4		3.3
8	3.6		4.0		6.4	7.5	8.4	5.3	3.9			
9					6.8	7.2	8.0	5.2	3.9			
10					7.3	7.4	7.9	5.0	3.9			
11	3.6				7.4	7.4	7.8	4.9	3.9			
12			4.0		7.3	7.6	7.7	4.9	3.9		3.4	
13					6.3	6.9	7.6	4.9	3.9			
14		4.1	3.9		6.2	6.5	7.4	4.9	3.9			
15					7.0	6.3	7.3	5.0	3.9			
16					7.5	6.4	7.2	4.9	3.8	3.4		3.8
17		4.1	5.8		7.9	6.5	7.0	4.9	3.7			
18			6.8		8.0	6.6	6.9	4.8	3.7			
19			7.3		8.9	7.2	6.9	4.8	3.7			
20		4.0	6.6		8.4	7.4	6.9	4.7	3.6			

Daily gage height, in feet, of Merced River in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21			5.6		8.0	7.6	6.8	4.6	3.6		3.1	3.7
22	3.6				7.8	7.7	6.6	4.5	3.5			
23		4.1			6.9	7.6		4.4	3.5			
24			4.9		7.2	7.5		4.4	3.5	3.5		
25					7.4	8.0		4.3	3.5			
26		4.1	4.7		7.4	8.1	6.7	4.3	3.5			
27	3.6				8.0	8.3	6.7	4.3	3.5			
28	4.1		4.5		8.1	8.4	6.8	4.2	3.4	3.9		
29	3.9		4.4		8.0	8.2	6.5	4.2	3.4			
30					8.4	8.8	6.4	4.0	3.4		3.1	
31	3.8		4.6		9.1		6.4	3.9				
1908.												
1						5.9	4.7	4.4				
2						5.7	4.7	4.4			3.0	
3					5.2	5.4	4.7	4.3				
4	3.7				5.3	5.3	4.7	4.2				3.1
5					5.5	5.2	4.8					
6					5.7	5.1	4.7					
7					5.3	5.2	4.7			3.0		
8					5.2	5.2	4.6					
9					5.2	5.4	4.5					
10					5.2	5.5	4.5					
11	3.6				5.1	5.6	4.4					
12					5.1	5.6	4.4					
13					5.0	5.7	4.3					
14					5.0	5.7	4.2				3.0	
15					5.0	5.7	4.2					
16					5.2	5.6	4.1			3.2		
17					5.4	5.6	4.1			3.2		
18					5.4	5.5	4.0					2.9
19					5.3	5.5	4.0				2.9	
20	3.6				5.1	5.4	4.0					
21					5.2	5.3	4.0					
22					5.2	5.3	3.9					
23					5.5	5.1	3.9					
24					5.9	5.1	3.9					
25					6.0	5.0	3.8					
26					6.1	4.9	3.8				3.0	
27					6.1	4.8	3.8			3.0		
28					6.3	4.8	3.8					3.0
29					6.5	4.8	3.8					
30					6.2	4.7	4.6					
31					6.0		4.5					

Rating table for Merced River in Yosemite Valley, Cal., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	10	4.10	272	5.30	836	7.00	1,920
3.00	20	4.20	310	5.40	890	7.20	2,070
3.10	32	4.30	350	5.50	946	7.40	2,220
3.20	46	4.40	392	5.60	1,002	7.60	2,370
3.30	62	4.50	436	5.70	1,060	7.80	2,530
3.40	80	4.60	482	5.80	1,120	8.00	2,690
3.50	100	4.70	530	5.90	1,180	8.20	2,850
3.60	122	4.80	578	6.00	1,240	8.40	3,010
3.70	146	4.90	628	6.20	1,370	8.60	3,170
3.80	173	5.00	678	6.40	1,500	8.80	3,340
3.90	203	5.10	730	6.60	1,640	9.00	3,510
4.00	236	5.20	782	6.80	1,780	10.00	4,380

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1906 to 1908 and the form of the previous curve. Above gage height 3.3 feet, the table is fairly well denned; below gage height 3.3 feet it is approximate.

Monthly discharge of Merced River in Yosemite Valley, Cal., for 1906, 1907, and 1908.

[Drainage area, 236 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
May 23-31	1,920	1,060	1,460	6.19	2.07	26,100	A.
June	4,380	1,240	3,140	13.3	14.84	187,000	A.
July	4,200	1,500	2,980	12.6	14.53	183,000	A.
August	1,370	350	790	3.35	3.86	48,600	A.
September	350	100	190	.805	.90	11,300	C.
October	122	46	80.1	.339	.39	4,930	C.
November	100	46	61.2	.259	.29	3,640	C.
December			71.7	.304	.35	4,410	D.
The period						469,000	
1907.							
January			153	.648	.75	9,410	C.
February			272	1.15	1.20	15,100	C.
March			576	2.44	2.81	35,400	C.
May	3,600	1,370	2,250	9.53	10.99	138,000	A.
June	3,600	1,440	2,480	10.5	11.71	148,000	A.
July	3,510	1,500	2,290	9.70	11.18	141,000	A.
August	1,440	203	664	2.81	3.24	40,800	A.
September	203	80	158	.670	.75	9,400	C.
October			116	.492	.57	7,130	D.
November			61.0	.258	.29	3,630	D.
December			127	.538	.62	7,810	D.
The period						556,000	
1908.							
January			130	.551	.64	7,990	D.
May	1,570	678	935	3.96	4.56	57,500	A.
June	1,180	530	851	3.61	4.03	50,600	A.
July	578	173	347	1.47	1.70	21,300	B.
October			33.0	.140	.16	2,030	D.
November			17.5	.074	.08	1,040	D.
December			30.7	.130	.15	1,890	D.
The period						142,000	

NOTE.—Discharges were interpolated December 12 to 31, 1906, and for the days when gage was not read, in March, 1907. For January, February, and October to December, 1907, and January and October to December, 1908, the mean of days when record was obtained was taken as the mean for the month. No allowance made for possible ice conditions during the winter months. Gage heights for 1906 are given in Water-Supply Paper 213, p. 162.

MERCED RIVER ABOVE MERCED FALLS, CAL.

This station, which is located about 1½ miles above Merced Falls, was established April 6, 1901, to obtain information regarding the flow of Merced River at the point where it emerges from its canyon.

No important tributaries enter for 25 miles above or below the station.

No important diversions are made above the station. The water used for power development returns to the river. Below Merced Falls, however, the combined capacity of irrigating canals in the vicinity of Snelling exceeds the low water flow. All acquired water rights above Merced Falls are for power or mining development.

The flow at the station is probably affected somewhat at times by artificial regulation at some of the power dams several miles above. It is not believed, however, that pondage from the dam at Merced

Falls has any appreciable effect at the station. The bed of the stream at the station is composed of gravel, and is subject to some change at high water. The velocity is also very great at flood stages.

The gage datum has never been changed.

At low and moderate stages the records have a fair degree of accuracy. At high stages, however, they are subject to considerable error, due mainly to inaccuracy in gaging at such stages and to shifting channel.

Discharge measurements of Merced River above Merced Falls, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	W. F. Martin	292	1,030	12.64	6,280
May 27	do	290	1,140	12.85	7,600
May 31	do	308	1,380	13.76	10,300
June 1	do	310	1,530	14.23	11,600
July 6	do	268	947	12.40	5,400
July 8	W. V. Hardy	265	993	12.40	5,560
July 9	do	265	914	12.12	4,960
July 10	do	218	801	11.75	4,350
July 11	do	213	766	11.57	3,760
July 15	do	210	727	11.44	3,550
July 17	do	193	660	11.22	3,080
July 20	do	180	622	10.90	2,540
July 22	do	175	595	10.75	2,340
July 23	do	170	550	10.50	1,990
July 29	W. A. Lamb	176	554	10.50	2,070
July 30	do	173	548	10.45	1,740
July 31	do	170	510	10.30	1,580
August 5	do	155	470	10.00	1,250
August 11	do	147	373	9.57	806
September 23	do	110	200	8.31	146
1908.					
March 2	W. F. Martin	165	441	10.00	1,230
May 2	W. A. Lamb	230	744	11.45	3,600
June 17	W. F. Martin	168	460	10.06	1,290
September 12	W. V. Hardy	102	177	8.16	102

Daily gage height, in feet, of Merced River above Merced Falls, Cal., for 1907 and 1908.

[C. Seigfeldt and C. Kelsey, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	9.9	10.6	10.15	11.75	12.5	13.95	12.65	10.35	8.7	8.25	8.6	8.2
2	9.55	11.5	10.0	12.0	12.55	14.15	12.4	10.35	8.75	8.2	8.6	8.2
3	9.4	12.05	10.0	11.95	12.75	14.1	12.45	10.2	8.7	8.2	8.55	8.2
4	9.35	11.55	10.25	11.55	12.6	14.1	12.8	10.1	8.75	8.15	8.5	8.2
5	10.25	11.5	11.55	11.4	12.1	13.85	12.75	9.95	8.65	8.3	8.5	8.5
6	9.85	11.1	11.85	11.3	11.95	13.6	12.25	9.95	8.7	8.2	8.4	9.4
7	9.6	10.85	11.65	11.25	11.95	13.1	12.1	9.85	8.7	8.2	8.4	8.75
8	11.0	10.65	11.1	11.35	11.95	12.5	12.15	9.85	8.6	8.25	8.4	8.65
9	10.45	10.6	10.9	11.6	12.4	12.35	11.95	9.75	8.6	8.1	8.4	9.35
10	10.65	10.6	12.55	11.85	12.75	12.8	11.7	9.65	8.6	8.2	8.35	8.95
11	10.2	10.45	13.9	12.0	12.95	13.1	11.55	9.55	8.6	8.2	8.4	8.8
12	9.9	10.4	12.7	12.35	12.45	12.85	11.55	9.45	8.6	8.2	8.4	8.8
13	9.6	10.3	11.85	12.6	11.9	12.15	11.6	9.4	8.6	8.2	8.4	8.7
14	10.0	10.2	11.25	12.9	11.8	11.5	11.4	9.35	8.6	8.2	8.3	8.75
15	10.2	10.1	11.0	12.6	12.3	11.3	11.25	9.4	8.6	8.2	8.3	8.7
16	10.1	10.1	10.85	12.25	12.9	11.25	11.2	9.45	8.55	8.1	8.3	8.7
17	10.05	10.3	15.2	12.25	13.0	11.2	11.1	9.45	8.5	8.2	8.25	8.7
18	10.05	10.25	14.8	12.55	13.45	11.3	11.1	9.45	8.45	8.15	8.25	8.6
19	9.85	10.0	18.0	12.85	13.75	12.05	11.1	9.45	8.4	8.15	8.3	8.6
20	9.75	9.95	16.05	13.05	13.45	12.55	11.0	9.25	8.4	8.2	8.3	8.6

Daily gage height, in feet, of Merced River above Merced Falls, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	9.8	9.9	14.8	13.0	13.25	12.8	10.85	9.2	8.35	8.15	8.2	8.6
22	9.95	11.55	13.95	13.0	13.05	12.75	10.75	9.1	8.35	8.2	8.2	8.6
23	9.95	10.7	13.55	13.0	12.45	12.3	10.65	9.05	8.3	8.3	8.25	8.6
24	10.0	10.55	16.55	13.05	12.1	12.05	10.75	9.0	8.25	8.3	8.2	8.6
25	10.45	10.45	15.6	12.9	12.45	12.5	10.8	8.9	8.2	8.3	8.2	8.6
26	10.6	10.7	13.65	13.0	12.8	12.5	10.7	8.9	8.25	8.4	8.2	8.6
27	10.25	10.3	12.75	12.95	12.85	12.7	10.65	8.85	8.2	8.4	8.2	8.6
28	15.6	10.25	12.3	12.9	13.1	12.8	10.65	8.85	8.25	8.65	8.2	8.6
29	12.7	.....	11.95	12.85	13.3	12.4	10.6	8.8	8.25	8.7	8.2	8.8
30	11.4	.....	11.85	12.6	13.45	13.05	10.45	8.8	8.3	8.7	8.2	8.9
31	10.75	.....	11.85	.....	13.85	.....	10.3	8.7	.....	8.6	.....	9.15
1908.												
1	9.15	8.9	9.6	9.45	11.55	10.3	9.45	9.0	7.95	8.1	8.1	7.8
2	8.9	8.9	10.0	9.45	11.45	10.25	9.35	9.0	7.9	8.2	8.0	7.95
3	8.85	8.9	9.75	9.45	11.1	10.15	9.4	8.95	7.95	8.0	8.0	8.0
4	8.9	9.3	9.55	9.5	10.65	10.0	9.45	8.95	7.9	7.8	8.0	8.05
5	8.85	9.25	9.55	9.65	10.55	9.95	9.45	8.8	7.7	8.0	7.9	8.35
6	8.75	9.1	9.55	9.85	10.7	9.95	9.45	8.7	7.7	7.9	7.85	8.5
7	8.7	9.1	9.5	9.8	11.0	10.15	9.35	8.65	7.7	7.7	7.85	8.4
8	8.7	9.0	9.4	9.6	10.75	10.4	9.35	8.6	7.7	7.95	7.85	8.3
9	8.7	9.15	9.35	9.65	10.45	10.5	9.3	8.6	7.7	7.9	7.6	8.25
10	8.8	9.5	9.35	9.9	10.25	10.5	9.15	8.55	7.85	7.9	7.85	8.25
11	8.8	9.15	9.4	10.25	10.2	10.5	9.05	8.5	8.15	7.95	7.8	8.25
12	8.8	9.15	9.45	10.6	10.3	10.45	9.1	8.45	8.15	8.2	7.95	8.25
13	8.8	9.15	9.45	10.75	10.2	10.45	9.1	8.4	8.3	7.9	7.9	8.25
14	9.65	9.0	9.6	10.7	10.05	10.4	9.1	8.4	8.3	8.05	7.85	8.25
15	9.45	9.0	9.75	10.8	10.2	10.3	9.0	8.4	8.25	7.95	7.85	8.2
16	9.05	8.9	9.95	10.6	10.2	10.15	8.9	8.3	8.2	7.8	7.85	8.2
17	8.95	8.95	10.1	10.4	10.15	10.1	8.8	8.3	8.2	8.15	7.85	8.2
18	8.9	8.9	10.15	10.6	10.15	9.95	8.7	8.3	8.2	8.5	7.8	7.95
19	8.9	8.9	10.15	10.9	10.35	9.85	8.7	8.3	8.1	8.3	7.85	8.2
20	8.8	8.9	10.15	11.2	10.4	9.8	8.75	8.3	8.1	8.3	7.8	8.05
21	8.8	8.9	10.2	11.2	10.2	9.75	8.75	8.3	8.2	8.3	7.6	8.1
22	8.8	8.55	10.1	10.85	10.35	9.65	8.75	8.05	8.25	8.25	7.8	7.95
23	8.8	8.8	10.1	10.65	10.5	9.55	8.75	7.9	8.25	8.25	8.25	8.05
24	9.1	8.8	10.2	10.4	10.8	9.55	8.75	8.2	8.25	8.25	8.25	8.1
25	10.4	8.8	10.25	10.4	11.0	9.65	8.75	8.2	8.25	8.05	8.1	8.05
26	10.05	8.9	10.15	10.6	10.95	9.65	8.65	8.2	8.2	7.7	8.2	8.05
27	9.45	9.05	9.9	10.95	10.75	9.6	8.7	8.2	8.2	8.1	8.25	8.05
28	9.25	9.2	9.7	11.5	10.75	9.55	8.75	8.2	8.2	8.2	8.2	8.1
29	9.1	9.75	9.65	11.6	10.85	9.5	8.85	7.9	8.2	8.2	8.1	8.1
30	9.0	.....	9.6	11.5	10.9	9.45	8.8	7.9	8.1	8.25	8.2	8.1
31	8.95	.....	9.6	.....	10.6	.....	9.05	8.2	.....	8.25	.....	8.1

Rating tables for Merced River above Merced Falls, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
8.00	50	9.30	655	10.60	1,970	12.80	6,490
8.10	75	9.40	720	10.70	2,110	13.00	7,020
8.20	105	9.50	790	10.80	2,260	13.20	7,600
8.30	140	9.60	860	10.90	2,420	13.40	8,200
8.40	180	9.70	940	11.00	2,600	13.60	8,800
8.50	220	9.80	1,030	11.20	2,970	13.80	9,420
8.60	260	9.90	1,130	11.40	3,350	14.00	10,100
8.70	305	10.00	1,230	11.60	3,740	15.00	13,840
8.80	355	10.10	1,340	11.80	4,160	16.00	17,800
8.90	415	10.20	1,450	12.00	4,600	17.00	22,300
9.00	475	10.30	1,570	12.20	5,040	18.00	27,500
9.10	535	10.40	1,700	12.40	5,520		
9.20	595	10.50	1,830	12.60	6,000		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty discharge measurements made during 1907 and is well defined between gage heights 8.0 feet and 13.0 feet. The upper part of the table was determined by the weir formula for the dam at Merced Falls, 1½ miles below the station.

Rating tables for Merced River above Merced Falls, Cal.—Continued.

FOR 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.60	35	7.90	55	8.10	90	8.30	145
7.70	40	8.00	70	8.20	115	8.40	180
7.80	45						

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1907 and 1908 and is fairly well defined. Above 8.4 feet it is the same as the 1907 table.

Monthly discharge of Merced River above Merced Falls, Cal., for 1907 and 1908.

[Drainage area, 1,090 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	16,200	687	2,040	1.87	2.16	125,000	A.
February	4,710	1,130	2,100	1.93	2.01	117,000	A.
March	27,500	1,230	7,460	6.84	7.89	459,000	A.
April	7,160	3,060	5,490	5.04	5.62	327,000	A.
May	9,590	4,160	6,370	5.84	6.73	392,000	A.
June	10,600	2,970	6,330	5.81	6.48	377,000	A.
July	6,490	1,570	3,460	3.17	3.66	213,000	A.
August	1,640	305	792	.727	.84	48,700	A.
September	330	105	219	.201	.22	13,000	A.
October	305	75	135	.124	.14	8,300	A.
November	260	105	154	.141	.16	9,160	A.
December	720	105	308	.283	.33	18,900	A.
The year	27,500	75	2,910	2.66	36.24	2,110,000	
1908.							
January	1,700	305	517	.474	.55	31,800	A.
February	985	240	496	.455	.49	28,500	A.
March	1,510	687	1,040	.954	1.10	64,000	A.
April	3,740	755	1,870	1.72	1.92	111,000	A.
May	3,640	1,280	2,000	1.83	2.11	123,000	A.
June	1,830	755	1,270	1.17	1.30	75,600	A.
July	755	282	488	.448	.52	30,000	A.
August	475	55	203	.186	.21	12,500	A.
September	145	40	93.9	.086	.10	5,590	A.
October	220	40	94.3	.087	.10	5,800	A.
November	130	35	69.6	.064	.07	4,140	A.
December	220	45	105	.096	.11	6,460	A.
The year	3,740	35	687	.631	8.58	498,000	

TENAYA CREEK IN YOSEMITE VALLEY, CAL.

Tenaya Creek heads in small lakes above Tenaya Lake at an altitude of 10,000 feet, and flows southwestward to its junction with Merced River in the upper end of Yosemite Valley. For about 6 miles it flows through the beautiful Tenaya Canyon, which opens into the Yosemite Valley. From Tenaya Lake, through which it flows, to its mouth, a distance of about 10 miles, the creek has a fall of 4,000 feet.

Considerable storage capacity can be obtained at Tenaya Lake.

The gaging station is located at the wagon bridge below Mirror Lake and about 2 miles east of Yosemite post-office. It was established July 11, 1904, to obtain data for comparisons of flow with that of the station on Merced River at Yosemite and is maintained during only the summer season.

The gage datum has never been changed. Conditions for obtaining discharge data are very good, and the results are reliable.

Discharge measurements of Tenaya Creek in Yosemite Valley, Cal., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 11	C. W. Tucker	44	176	7.20	891
1907.					
May 7	C. W. Tucker	42	115	5.50	378
May 19	do	42	176	6.85	863
May 23	Martin and Tucker	45	138	5.83	475
May 25	W. F. Martin	45	145	6.03	530
June 4	C. W. Tucker	45	192	7.05	949
June 24	do	45	147	6.05	562
August 16	Clapp and Hardy	40	41	3.75	35
1908.					
August 4	W. V. Hardy	6	2.6	3.13	3.1

Daily gage height, in feet, of Tenaya Creek in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1					5.7	6.9	5.9	4.5	3.4			3.2
2					5.7	6.9	6.0	4.4	3.4		3.3	
3			3.9		5.5	7.0	5.8	4.3	3.4			
4	3.6				5.4	7.1	6.0	4.2	3.4			
5					5.5	7.0	6.1	4.2	3.4			
6					5.4	6.4	6.0	4.1	3.3			
7					5.3	6.5	6.0	4.0	3.3			
8		4.2			5.2	6.4	5.9	4.0	3.3			3.4
9					5.4	6.1	5.9	3.9	3.3	3.2		
10	3.6				5.6	6.5	5.9	3.9	3.3			
11					5.5	6.3	5.8	3.8	3.2			
12					5.5	6.4	5.6	3.8	3.2		3.2	
13		4.0			5.4	5.6	5.5	3.8	3.2			
14					5.4	5.2	5.4	3.8	3.2			
15					5.7	5.1	5.4	3.9	3.2			
16					6.1	5.2	5.2	3.8	3.2			3.8
17					6.2	5.4	5.2	3.9	3.2	3.3		
18		4.1	6.7		6.4	5.5	5.1	3.9	3.2			
19					6.5	5.8	5.0	3.8	3.2		3.2	
20					6.2	6.0	5.0	3.7	3.1			3.6
21					6.0	6.3	4.9	3.7	3.1			
22			4.8		5.6	6.3	4.8	3.6	3.1			
23					5.8	6.1		3.6	3.1			
24					6.0	6.0		3.5	3.1			
25					6.0	6.1		3.5	3.1			
26					6.4	6.3	4.7	3.5	3.1			
27		4.0			6.5	6.4	4.7	3.4	3.1	3.7		
28					6.7	6.3	4.7	3.5	3.1			
29					6.7	6.2	4.6	3.5	3.1			3.8
30	4.0		4.3		6.9	6.5	4.6	3.5	3.1		3.2	
31					7.0		4.5	3.5				

Daily gage height, in feet, of Tenaya Creek in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1						4.2	3.7	3.3				
2						4.2	3.6	3.3				
3					4.4	4.3	3.6	3.3				3.0
4	3.7				4.6	4.4	3.6	3.2				
5					4.7	4.6	3.6					
6					4.8	4.5	3.6					
7					4.5	4.6	3.5				3.0	
8					4.5	4.7	3.5					
9					4.5	4.7	3.5					
10					4.6	4.7	3.5					
11					4.6	4.6	3.4					
12					4.4	4.7	3.4					
13	3.7				4.4	4.6	3.3			3.2		
14					4.3	4.6	3.3					
15					4.2	4.4	3.3					
16					4.3	4.3	3.3					3.0
17					4.3	4.3	3.2					
18					4.3	4.2	3.2					2.9
19					4.1	4.1	3.2					
20	3.7				4.2	4.1	3.2					
21					4.3	4.0	3.2					
22					4.3	4.0	3.1					
23					4.5	3.9	3.1			3.1	3.0	
24					4.4	3.8	3.1					
25					4.5	3.8	3.1					
26					4.6	3.7	3.1					
27					4.6	3.7	3.1					
28	5.7				4.6	3.7	3.1					
29					4.5	3.7	3.1					
30					4.3	3.7	3.6					
31					4.1		3.4					3.0

Rating tables for Tenaya Creek in Yosemite Valley, Cal.

JANUARY 1 TO JUNE 16, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.50	293	6.20	480	6.90	722	7.60	1,035
5.60	317	6.30	512	7.00	760	7.70	1,080
5.70	342	6.40	544	7.10	800	7.80	1,125
5.80	368	6.50	578	7.20	840	7.90	1,175
5.90	395	6.60	612	7.30	882	8.00	1,225
6.00	422	6.70	648	7.40	946	8.10	1,275
6.10	450	6.80	684	7.50	990		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906, and is well defined between gage heights 3.35 feet and 6.0 feet. Below 6.40 feet it is the same as the 1905 table.

JUNE 17, 1906, TO DECEMBER 31, 1908.

2.90	0.5	4.00	63	5.10	274	6.40	667
3.00	1.0	4.10	76	5.20	301	6.60	740
3.10	2.0	4.20	90	5.30	328	6.80	820
3.20	4.0	4.30	105	5.40	356	7.00	900
3.30	7.0	4.40	121	5.50	384	7.20	980
3.40	11	4.50	138	5.60	413	7.40	1,060
3.50	16	4.60	156	5.70	442	7.60	1,150
3.60	22	4.70	176	5.80	472	7.80	1,240
3.70	30	4.80	198	5.90	502		
3.80	40	4.90	222	6.00	533		
3.90	51	5.00	248	6.20	598		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908 and the general form of the previous curve. It is fairly well defined above gage height 3.1 feet.

Monthly discharge of Tenaya Creek in Yosemite Valley, Cal., for 1906, 1907, and 1908.

Drainage area, 47 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
May 25–31	480	293	424	9.02	2.35	5,050	B.
June	1,280	317	764	16.3	18.19	45,500	B.
July	1,020	176	649	13.8	15.91	39,900	B.
August	156	11	70.3	1.48	1.71	4,320	B.
September	16	.5	2.62	.056	.06	156	C.
October	1.0	.5	.53	.011	.01	33	D.
November	4.0	1.0	1.27	.027	.03	76	C.
December 1–11	1.0	1.0	1.00	.021	.01	22	C.
The period						95,100	
1907.							
January			36	.766	.88	2,210	D.
February			73	1.55	1.61	4,050	D.
March			280	5.96	6.87	17,200	D.
May	900	301	516	10.9	12.57	31,700	B.
June	940	274	609	12.9	14.39	36,200	B.
July	565	138	338	7.19	8.29	20,800	B.
August	138	11	47.4	1.01	1.16	2,910	B.
September	11	2	4.93	.105	.12	293	C.
October			14	.298	.34	861	D.
November			5.0	.106	.12	298	D.
December			24	.511	.59	1,480	D.
The period						118,000	
1908.							
May	198	76	125	2.66	3.07	7,690	B.
June	176	30	100	2.13	2.38	5,950	B.
July	30	2	10.4	.221	.25	640	C.
August			6.0	.128	.15	369	D.
October			3.0	.064	.07	184	D.
November			1.0	.021	.02	60	D.
December			.9	.019	.02	55	D.
The period						14,900	

NOTE.—For January to March and October to December, 1907, and for August and October to December, 1908, the mean of days when record was obtained was taken as mean for month. No allowance was made for possible ice conditions during the winter months.

YOSEMITE CREEK IN YOSEMITE VALLEY, CAL.

Yosemite Creek rises in the northern part of Mariposa County, at an altitude of 9,600 feet, and flows southward through a rolling upland region to the brink of Yosemite Valley, whence it leaps 2,500 feet to the floor of the valley and enters Merced River nearly a mile below Yosemite post-office. Its total drainage area is about 44 square miles.

The gaging station, which is located at the wagon bridge below the falls, about one-half mile from Yosemite post-office, and is maintained during only the summer season, was established July 9, 1904, to obtain data for comparing the quantity of water passing over Yosemite Falls at different times, and thus determining the relative scenic magnificence of one of the most interesting features of the park. The falls are usually at their best in May or June.

Conditions for obtaining accurate discharge data are not very good. The stream bed is composed of granitic sand and fine gravel, and is subject to more or less change.

Discharge measurements of Yosemite Creek in Yosemite Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 5	C. W. Tucker	37	129	7.65	353
May 21	do	37	170	8.70	622
May 23	Tucker and Martin	44	155	7.70	409
May 25	W. F. Martin	42	213	9.00	825
June 3	C. W. Tucker	43	226	9.85	710
June 25	do	42	129	7.55	349
August 6	do	35	64	6.10	69
August 16	Clapp and Hardy	23	16	5.90	34
1908.					
June 6	C. W. Tucker	37	78	6.50	115
August 4	Tucker and Hardy	7	2.8	5.40	3.7

Daily gage height, in feet, of Yosemite Creek in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1			5.7		8.0	9.5	8.2	6.2	5.6			
2			5.6		8.5	9.7	8.3	6.3	5.6			
3	5.3				8.3	9.9	8.2	6.2	5.6		5.5	
4					8.0	9.8	8.7	6.2	5.6			
5					7.6	9.4	8.4	6.2	5.6			
6			5.7		7.4	8.6	8.4	6.1	5.6			
7		5.9			7.8	8.4	8.0	6.1	5.6			5.6
8					8.0	8.2	7.8	6.0	5.6			
9					7.8	7.9	7.6	6.0	5.6			
10					8.0	8.3	7.6	6.0	5.6			
11	5.3				8.3	8.2	7.4	5.9	5.6	5.3		
12			5.6		8.0	8.5	7.4	5.9	5.6		5.3	
13					7.4	7.6	7.2	5.9	5.6			
14			5.6		7.2	7.5	7.1	5.9	5.6			
15					7.8	7.3	7.0	6.0	5.5			
16					8.5	7.5	7.0	5.9	5.5			5.7
17			7.6		8.7	7.4	6.9	5.9	5.5			
18			8.5		9.0	7.5	6.8	5.9	5.5			
19			9.7		9.5	7.7	6.9	5.9	5.5			
20					9.0	8.0	6.9	5.8	5.5			
21		5.7	10.0		8.6	8.2	6.7	5.8	5.4		5.3	5.7
22	5.3				8.1	8.3	6.5	5.8	5.4			
23					7.7	7.9		5.7	5.4	5.3		
24					7.9	7.6		5.7	5.4			
25			11.0		9.0	7.9		5.7	5.4			
26					8.4	8.0	6.6	5.7	5.4			
27		5.7			8.5	8.2	6.6	5.6	5.4	5.8		
28					8.6	8.4	6.6	5.7	5.4	5.7		
29					8.6	8.3	6.6	5.7	5.4			
30					8.8	8.5	6.5	5.7	5.4		5.3	
31			6.3		9.9		6.3	5.7		5.6		5.7
1908.												
1						6.5	5.7	5.6				
2						6.6	5.7	5.5				
3					6.9	6.4	5.6	5.5				
4					7.0	6.4	5.6	5.4		5.4		
5	5.7				7.2	6.4	5.6					5.5
6					7.3	6.5	5.5					
7					7.0	6.5	5.5					
8					6.8	6.5	5.4					
9					6.8	6.6	5.4					
10					6.8	6.6	5.4				5.2	

Daily gage height, in feet, of Yosemite Creek in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11					6.7	6.7	5.4					
12	5.7				6.7	6.7	5.4					
13					6.6	6.8	5.4					
14					6.5	6.7	5.4					
15					6.6	6.6	5.4					
16					6.7	6.5	5.4			5.6		
17					6.6	6.4	5.4					
18					6.5	6.3	5.4					
19					6.5	6.3	5.4					
20					6.6	6.3	5.4			5.3		
21					6.6	6.2	5.4					
22					6.7	6.2	5.4					5.4
23					6.9	6.1	5.4					
24					7.0	6.1	5.4				5.3	
25					7.1	6.0	5.4					
26	5.7				7.0	6.0	5.4					
27					7.1	5.9	5.4					
28					7.2	5.9	5.4					
29					7.0	5.9	5.5	5.2				
30					6.8	5.8	5.9		5.2			
31					6.6		5.8			5.3		

TUOLUMNE RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Tuolumne River lies on the western slope of the Sierra, north of the Merced basin and south of the Stanislaus basin. For a distance of about 50 miles the Sierra divide separates this basin from Mono Lake and Walker River basins to the east. The Tuolumne basin is roughly trapezoidal in shape, ranging in average width from about 15 miles in the San Joaquin Valley to 30 miles near the eastern border. The length of the basin is about 105 miles, two-thirds of which is mountainous. The total area of the mountainous part of the drainage basin is about 1,680 square miles, and lies almost wholly in Tuolumne County.

Tuolumne River has its source in numerous glacial lakes nestling in the shadow of high peaks on or near the Sierra divide, and flows southwestward to its junction with the San Joaquin, 10 miles west of Modesto. Its principal headwaters come from the glacier and lakes on the northern slope of Mount Lyell to the north and east of the headwaters of Merced River. The course of the river is through beautiful upland meadows in its upper part, then through a canyon nearly 80 miles long, which has been cut out of solid granite. The upper part of this canyon, for a distance of about 25 miles, is from 3,000 to 4,000 feet deep, and is known as the Grand Canyon of the Tuolumne. At the lower end of the Grand Canyon is Hetch Hetchy Valley, which is smaller than Yosemite Valley, but in every other way resembles it very much. Finally, the river passes through the

lower canyon into the San Joaquin Valley, which it enters near Lagrange. Its total length is about 150 miles.

Nearly all the tributaries of Tuolumne River enter from the north. In order from east to west, the principal ones are Return, Rancheria, Falls, and Cherry creeks, Clavey River, North Fork Tuolumne, and Woods Creek. Eleanor Creek is tributary to Cherry Creek. South Fork of Tuolumne River is tributary to the main stream from the south. Middle Fork is tributary to South Fork.

The Tuolumne basin is rough and rugged. The formation consists of granite, which at the higher altitudes is bare and glaciated and in places towers thousands of feet in vertical cliffs and domes.

Altitudes in this basin range from about 300 feet in the foothills to 12,000 and 13,000 feet along the crest of the Sierra divide. The upper part of the basin is practically devoid of forest cover. On the middle reaches, however, there is a heavy growth of coniferous timber, which becomes less dense with decrease of altitude. The forest cover in the foothill region consists of grass, brush, and scattering timber. About 1,200 square miles of the upper part of the basin is included in national park and forest.

The mean annual precipitation varies with altitude: In the San Joaquin Valley it is about 10 inches and in the foothill region about 30 inches; at the higher elevations it is probably 60 inches. On the upper half of the basin the precipitation occurs chiefly as snow, the greater part of which disappears in the spring; on the higher peaks much snow lasts until late summer. On the northern slope of Mount Lyell, at the head of this basin is one of the few glaciers still remaining in the Sierra.

The only opportunities for irrigation in the Tuolumne basin are in the San Joaquin Valley below the foothills. The Turlock and Modesto irrigation districts now divert water from Tuolumne River above La Grange for irrigating a large acreage in the valley on both sides of the river.

Excellent storage sites exist in the Tuolumne basin. Many glacial lakes throughout the upper reaches of the basin, especially in the northern part, afford exceptional opportunities for constructing storage reservoirs, and there are also a number of storage sites on the main river.

Tuolumne River has a heavy gradient, and the opportunities for power development are great. The minimum flow of the stream, however, is small and only about 35,000 horsepower could be developed continuously without storage. This amount could be increased to more than 300,000 horsepower by utilizing the storage possibilities.

The longest run-off record in the basin dates from 1895. The wettest year at the station since that time was 1907, and the driest 1898. The total flow during the wettest year was about four and

one-half times that of the driest year. The flow in 1906 was nearly as great as in 1907, and 1908 was almost as dry as 1898. The high-water mark of the flood in 1862 indicates a greater maximum discharge than has occurred since 1895.

The following gaging stations have been maintained in this basin:

Tuolumne River at Lagrange (1895 to 1908).
Turlock canal near Lagrange (1899 to 1908).
Modesto canal near Lagrange (1903 to 1908).

TUOLUMNE RIVER AT LAGRANGE, CAL.

This station, which is located on the wagon bridge at Lagrange, about 2 miles below the Lagrange dam and headworks of Turlock and Modesto canals, and one-half mile below the powerhouse of the Lagrange Water and Power Company, was established August 29, 1895, to determine the value of the Tuolumne for irrigation and power development. The data obtained are also useful in studying the flood problem in the lower San Joaquin. Since April 1, 1908, the gage record has been kept at the dam and estimates of flow made by using it as a weir. (See Pl. VI, *A*.) At critically low stages, however, it is necessary to determine the flow from the station at the bridge below.

Woods Creek unites with the main stream from the north about 20 miles above Lagrange. No other tributaries of importance enter near the station.

Three important diversion systems take water from Tuolumne River above Lagrange: The Turlock and Modesto canals take water at Lagrange dam from the left and right banks, respectively, for irrigation in the San Joaquin Valley. The Lagrange Water and Power Company's canal takes water from the left bank about 17 miles above Lagrange. The diverted water is used chiefly for power development and all water so used is returned to the river below the dam and above the bridge gaging station on the river. No gage records have been kept on this canal, but from measurements of flow made at various times the mean daily flow has been estimated at a little less than 20 second-feet, or a total of 21,000 acre-feet for the year 1908. Water rights already acquired on this stream are considerably in excess of the low-water flow. It is practically impossible to determine the minimum flow of the stream very closely because of the diversions. During the late summer and fall the power and irrigation canals take the total flow and no water passes over the dam for several months at a time. Regular stations are maintained on the two irrigation canals, and enough gagings made on the power canal to make an estimate of its average flow; but enough water seeps around and through the dam and from the canals to affect appreciably the estimate of minimum flow. Then,

too, a part of the water diverted by the power canal is returned to the river above the gaging station at Lagrange. The minimum flow may be affected, also, by pondage above the dam.

The gage datum at the bridge has never been changed. The datum at the dam, which is now being used as a weir, is the average crest level.

Conditions for obtaining accurate discharge data at Lagrange are very good, except for the changing conditions of control above described. Except for minimum flow, therefore, full reliance can be placed on the records at this station.

Discharge measurements of Tuolumne River at Lagrange, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	W. F. Martin	347	2,450	8.40	8,460
May 28	do	348	2,680	9.10	11,200
May 31	do	349	2,970	9.85	14,600
August 1	W. A. Lamb	312	1,600	5.80	3,060
August 16	W. F. Martin	254	1,060	4.29	933
November 15	W. A. Lamb	220	882	3.53	228
1908.					
March 3	W. F. Martin	253	1,050	4.35	1,050
May 1	W. A. Lamb	314	1,720	6.15	5,370
Do	do	314	1,750	6.20	5,600
June 16	W. F. Martin	260	1,210	4.70	1,910
September 11	W. V. Hardy	33	25	[a] 2.70	23
December 9	W. F. Martin	230	865	3.47	346

[a] Estimated.

Daily gage height, in feet, of Tuolumne River at Lagrange, Cal., for 1907 and 1908.

[Bert Clark, observer.]

Day.	Jan.	Feb.	Mar.	Apr.[a]	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.9	6.25	6.0	8.4	8.5	10.0	8.9	6.05	2.75	2.5	3.9	3.5
2	5.55	8.7	6.0	8.4	8.45	10.4	8.6	5.95	2.8	2.5	3.85	3.5
3	5.5	8.1	5.9	8.4	8.5	10.35	8.9	5.9	2.8	2.65	3.8	3.5
4	5.4	8.2	6.15	8.4	8.35	10.3	9.25	5.6	2.8	2.7	3.8	3.55
5	6.0	7.95	7.4	8.4	8.05	9.95	9.3	5.25	2.8	2.6	3.7	3.5
6	5.6	7.35	7.05	8.4	7.85	9.6	8.55	5.25	2.8	2.6	3.7	3.5
7	5.5	7.0	6.85	8.4	7.9	9.05	8.4	5.25	2.8	2.6	3.7	4.3
8	6.6	6.8	6.45	8.4	7.8	8.5	8.3	5.2	2.8	3.1	3.7	4.2
9	6.05	6.6	6.5	8.4	8.1	8.5	8.25	[b] 5.1	2.8	3.7	3.7	4.0
10	6.0	6.5	9.4	8.4	8.4	8.6	8.1	[b] 5.0	2.8	3.6	3.65	3.9
11	5.7	6.5	8.0	8.4	8.5	9.1	8.0	[b] 4.85	2.8	3.6	3.8	4.65
12	5.5	6.3	7.45	8.4	8.4	8.9	8.0	[b] 4.7	2.8	3.3	3.7	4.2
13	6.2	6.1	7.0	8.5	7.9	8.1	7.95	[b] 4.6	2.8	3.6	3.6	4.0
14	6.0	6.05	6.75	8.5	7.8	7.7	7.7	[b] 4.5	2.8	3.65	3.55	4.05
15	6.0	6.05	6.55	8.5	8.0	7.35	7.5	[b] 4.4	2.8	3.6	3.5	4.0
16	5.7	6.1	6.55	8.5	8.4	7.2	7.3	[b] 4.3	2.8	3.5	3.5	3.95
17	5.8	6.25	11.2	8.5	8.7	7.15	7.2	4.2	2.8	3.4	3.6	4.0
18	5.7	6.15	13.5	8.5	9.05	7.15	7.2	4.2	2.6	3.45	3.6	3.95
19	5.5	5.95	15.75	8.5	9.3	7.75	7.2	4.2	2.6	3.1	3.7	3.85
20	5.4	5.9	13.0	8.6	9.3	8.2	7.2	3.85	2.6	3.5	3.65	3.8
21	5.4	5.85	11.5	8.6	8.95	8.45	7.0	3.6	2.6	3.5	3.5	3.85
22	5.6	7.7	10.5	8.6	8.75	8.7	6.75	3.45	2.6	3.6	3.5	3.8
23	5.5	6.9	9.8	8.6	8.25	8.2	6.6	3.35	2.55	3.6	3.5	3.8
24	5.55	6.55	10.65	8.6	8.05	7.9	6.7	3.2	2.5	3.6	3.5	3.85
25	5.8	6.5	10.65	8.6	8.4	7.9	6.8	3.05	2.5	3.6	3.5	3.8

[a] Gage out below 10 feet during April; gage heights obtained by measuring down to water surface from 10-foot mark.
[b] Estimated.

A. LAGRANGE DAM FROM LEFT BANK OF TUOLUMNE RIVER AT LAGRANGE.

B. CONCRETE-LINED CANAL AND TUNNEL PORTAL OF MAIN KLAMATH CANAL, NEAR KLAMATH FALLS, OREGON.

Daily gage height, in feet, of Tuolumne River at Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	6.0	6.5	9.3	8.6	8.7	8.2	6.9	2.75	2.5	3.6	3.5	3.85
27	5.9	6.25	8.5	8.5	8.8	8.4	6.75	2.7	2.5	3.85	3.5	4.0
28	9.6	6.1	8.25	8.5	8.9	8.8	6.7	2.7	2.5	4.0	3.5	4.6
29	6.85	.....	7.95	8.5	9.2	8.7	6.35	2.7	2.5	3.95	3.5	4.3
30	6.9	.....	8.15	8.5	9.35	9.05	6.0	2.85	2.5	3.9	3.5	4.3
31	6.35	.....	8.4	.....	9.5	.....	5.9	2.8	.....	3.9	.....	4.4
1908.												
1	4.4	3.9	4.3	.....	.....	.....	.....	.....	.....	3.0	2.6	3.4
2	4.3	3.9	4.3	.....	.....	.....	.....	.....	.....	3.0	2.95	3.4
3	4.2	4.0	4.3	.....	.....	.....	.....	.....	.....	2.9	3.1	3.4
4	4.2	4.25	4.15	.....	.....	.....	.....	.....	.....	2.7	a 3.3	3.45
5	4.15	3.85	4.1	.....	.....	.....	.....	.....	.....	2.7	3.5	3.65
6	4.0	3.8	4.1	.....	.....	.....	.....	.....	.....	2.75	a 3.4	.....
7	4.0	3.85	4.1	.....	.....	.....	.....	.....	.....	2.75	a 3.3	.....
8	4.0	3.8	4.0	.....	.....	.....	.....	.....	.....	2.75	a 3.2	.....
9	4.0	4.1	4.0	.....	.....	.....	.....	.....	.....	2.75	3.2	.....
10	4.05	4.25	4.05	.....	.....	.....	.....	.....	.....	2.8	3.2	.....
11	3.95	4.2	4.1	.....	.....	.....	.....	.....	.....	2.8	3.2	.....
12	3.95	4.0	4.3	.....	.....	.....	.....	.....	.....	2.7	3.2	.....
13	3.95	3.9	4.4	.....	.....	.....	.....	.....	.....	2.7	3.1	.....
14	4.7	3.8	4.55	.....	.....	.....	.....	.....	.....	2.7	a 3.1	.....
15	4.6	3.7	4.8	.....	.....	.....	.....	.....	.....	2.85	3.05	.....
16	4.35	3.7	5.0	.....	.....	.....	.....	.....	.....	4.5	3.1	.....
17	4.3	3.7	5.1	.....	.....	.....	.....	.....	.....	3.9	3.2	.....
18	4.15	3.75	4.95	.....	.....	.....	.....	.....	.....	3.7	3.2	.....
19	4.05	3.8	4.8	.....	.....	.....	.....	.....	.....	3.55	3.2	.....
20	4.0	3.75	4.9	.....	.....	.....	.....	.....	.....	3.45	3.3	.....
21	4.0	3.7	4.95	.....	.....	.....	.....	.....	.....	3.45	a 3.4	.....
22	4.05	3.7	4.5	.....	.....	.....	.....	.....	.....	3.4	3.6	.....
23	4.05	3.6	4.6	.....	.....	.....	.....	.....	.....	3.35	3.5	.....
24	4.6	3.6	4.65	.....	.....	.....	.....	.....	.....	3.35	3.5	.....
25	5.1	3.6	4.5	.....	.....	.....	.....	.....	2.85	3.35	3.5	.....
26	4.75	3.65	4.3	.....	.....	.....	.....	.....	3.1	3.35	a 3.4	.....
27	4.3	3.95	4.2	.....	.....	.....	.....	.....	2.7	3.4	3.35	.....
28	4.25	4.05	4.05	.....	.....	.....	.....	.....	3.1	3.4	3.3	.....
29	4.2	4.65	4.0	.....	.....	.....	.....	.....	3.1	3.35	3.3	.....
30	4.1	.....	4.0	.....	.....	.....	.....	.....	a 3.05	3.3	3.3	.....
31	4.0	.....	4.0	.....	.....	.....	.....	.....	.....	a 2.8	.....	.....

a Estimated.

Daily gage height, in feet, of Tuolumne River at Lagrange dam, near Lagrange, Cal., for 1908.

[J. W. Simmons, observer.]

Day.	Apr.	May.	June.	July.	Dec.	Day.	Apr.	May.	June.	July.	Dec.
1	0.55	3.30	1.75	0.60	.....	16	2.05	1.70	1.90	.....	0.45
2	.35	3.20	1.70	.75	.....	17	1.75	1.30	1.80	.....	.50
3	.18	2.65	1.55	.50	.....	18	1.70	1.28	1.50	.....	.45
4	.35	2.20	1.20	.50	.....	19	2.40	1.70	1.32	.....	.40
5	.62	2.00	1.15	.50	.....	20	2.90	1.85	1.15	.....	.45
6	.90	2.25	1.40	.45	0.75	21	2.90	1.50	.92	.....	.45
7	1.35	2.80	1.70	.40	.65	22	2.50	1.70	.80	.....	.45
8	1.22	2.25	2.10	.25	.....	23	2.30	1.55	.70	.....	.45
9	1.18	1.70	2.30	.10	.....	24	1.80	2.40	.98	.....	.45
10	1.32	1.40	2.35	.00	.60	25	1.65	3.00	1.05	.....	.40
11	1.50	1.35	2.30	.00	.60	26	1.60	2.90	1.00	.....	.30
12	2.00	1.75	2.20	.....	.55	27	2.05	2.50	.88	.....	.30
13	2.40	1.65	2.20	.....	.50	28	2.75	2.40	.75	.....	.30
14	2.60	1.70	2.25	.....	.50	29	3.00	2.70	.65	.....	.10
15	2.45	1.80	2.00	.....	.55	30	3.20	2.70	.60	.....	.00
						31	.....	2.20	.....	.....	.00

NOTE.—Record for January to March and September 25 to December 5, 1908, kept at the bridge station. From July 12 to September 24, 1908, all the water was diverted into the canals.

Rating tables for Tuolumne River at Lagrange, Cal.

JANUARY 1, 1906, TO MARCH 16, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.40	1,300	6.40	3,080	7.40	5,570	8.40	8,700
5.50	1,440	6.50	3,300	7.50	5,850	8.50	9,040
5.60	1,580	6.60	3,530	7.60	6,140	8.60	9,390
5.70	1,750	6.70	3,760	7.70	6,440	8.70	9,740
5.80	1,910	6.80	4,000	7.80	6,750	8.80	10,090
5.90	2,080	6.90	4,250	7.90	7,070	8.90	10,450
6.00	2,260	7.00	4,500	8.00	7,390	9.00	10,810
6.10	2,450	7.10	4,760	8.10	7,710	9.20	11,570
6.20	2,650	7.20	5,020	8.20	8,030	9.40	12,330
6.30	2,860	7.30	5,290	8.30	8,360		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 18 discharge measurements made during 1906 and is well defined.

MARCH 17 TO DECEMBER 31, 1907.

2.50	0	4.00	640	5.50	2,490	8.00	8,000
2.60	2	4.10	750	5.60	2,645	8.20	8,540
2.70	6	4.20	860	5.70	2,805	8.40	9,120
2.80	12	4.30	970	5.80	2,970	8.60	9,720
2.90	21	4.40	1,080	5.90	3,140	8.80	10,360
3.00	35	4.50	1,190	6.00	3,320	9.00	11,000
3.10	55	4.60	1,305	6.20	3,690	10.00	14,500
3.20	85	4.70	1,420	6.40	4,100	11.00	18,600
3.30	125	4.80	1,540	6.60	4,540	12.00	23,200
3.40	175	4.90	1,665	6.80	5,010	13.00	29,000
3.50	235	5.00	1,790	7.00	5,500	14.00	36,200
3.60	300	5.10	1,920	7.20	6,000	15.00	44,800
3.70	370	5.20	2,055	7.40	6,500	16.00	54,000
3.80	450	5.30	2,195	7.60	7,000		
3.90	540	5.40	2,340	7.80	7,500		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous high-water measurements and is well defined. The upper extension of curve is determined by applying the weir formula to simultaneous gage heights on the Lagrange dam.

JANUARY 1 TO DECEMBER 31, 1908.

2.60	10	3.30	230	4.00	810	4.70	1,860
2.70	20	3.40	290	4.10	930	4.80	2,050
2.80	40	3.50	360	4.20	1,060	4.90	2,250
2.90	60	3.60	430	4.30	1,200	5.00	2,460
3.00	90	3.70	510	4.40	1,350	5.10	2,680
3.10	130	3.80	600	4.50	1,510		
3.20	180	3.90	700	4.60	1,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1908 and is well defined.

Rating table for Tuolumne River at Lagrange dam, near Lagrange, Cal., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	29	1.80	2,180	3.50	5,920	6.40	14,650
.20	81	1.90	2,370	3.60	6,180	6.60	15,300
.30	149	2.00	2,560	3.70	6,440	6.80	16,080
.40	229	2.10	2,750	3.80	6,700	7.00	16,800
.50	320	2.20	2,950	3.90	6,970	7.20	17,520
.60	421	2.30	3,160	4.00	7,240	7.40	18,240
.70	530	2.40	3,370	4.20	7,800	7.60	18,980
.80	648	2.50	3,580	4.40	8,360	7.80	19,740
.90	772	2.60	3,800	4.60	8,930	8.00	20,500
1.00	905	2.70	4,020	4.80	9,510	9.00	24,400
1.10	1,040	2.80	4,240	5.00	10,110	10.00	28,600
1.20	1,180	2.90	4,470	5.20	10,740	11.00	33,000
1.30	1,340	3.00	4,700	5.40	11,380	12.00	37,600
1.40	1,500	3.10	4,940	5.60	12,020	13.00	42,400
1.50	1,660	3.20	5,180	5.80	12,660	14.00	47,400
1.60	1,830	3.30	5,420	6.00	13,300	15.00	52,600
1.70	2,000	3.40	5,670	6.20	13,960	16.00	57,900

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 20 discharge measurements made during 1906 to 1908 and the weir formula $Q=905\ h^{\frac{3}{2}}$ and is fairly well defined.

Monthly discharge of Tuolumne River at Lagrange, Cal., for 1907 and 1908.

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	13,200	1,300	2,460	1.64	1.89	151,000	A.
February	9,910	2,470	4,240	2.83	2.95	235,000	A.
March	52,000	2,230	11,200	7.47	8.61	689,000	A.
April	10,700	9,230	9,810	6.54	7.30	584,000	A.
May	13,900	8,300	10,500	7.00	8.07	646,000	A.
June	17,300	6,960	11,200	7.47	8.33	666,000	A.
July	13,200	4,360	8,210	5.47	6.31	505,000	A.
August	4,630	754	2,140	1.43	1.65	132,000	A.
September	820	264	496	.331	.37	29,500	A.
October	640	[a] 55	304	.203	.23	18,700	A.
November	540	235	322	.215	.24	19,200	A.
December	1,400	235	634	.423	.49	39,000	A.
The year	52,000	[a] 55	5,130	3.42	46.44	3,710,000	
1908.							
January	2,680	756	1,180	.787	.91	72,600	A.
February	2,270	806	1,000	.667	.72	57,500	A.
March	3,380	1,380	2,120	1.41	1.63	130,000	A.
April	6,490	1,280	3,500	2.33	2.60	208,000	A.
May	6,720	2,560	4,100	2.73	3.15	252,000	A.
June	4,710	1,630	3,070	2.05	2.29	183,000	A.
July	1,820	548	1,020	.680	.78	62,700	A.
August	927	151	390	.260	.30	24,000	B.
September	153	80	[b] 116	.077	.09	6,900	B.
October	1,540	60	219	.146	.17	13,500	B.
November	470	[a] 50	218	.145	.16	13,000	B.
December	635	260	362	.241	.28	22,300	B.
The year	6,720	[a] 50	1,440	.960	13.08	1,050,000	

[a] Minima are affected by pondage at Lagrange dam.
[b] Mean based on 20-day record.

NOTE.—The daily discharges for 1907 include those of Modesto and Turlock canals. The daily discharges for 1908 include those of Turlock and Modesto canals and also the Lagrange Water and Power Company's canal. During April, May, June, a part of July, and a part of December, the Lagrange dam was used as a weir to give the flow of the river, the formula being determined by previous meter measurements at the station below.

MODESTO CANAL NEAR LAGRANGE, CAL.

The Modesto canal, which diverts water from the right bank of Tuolumne River, is owned by the Modesto Irrigation District. The water is taken through a concrete bulkhead at the end of Lagrange dam. (See Pl. V, *A*.) The diverted water is used for irrigating 81,200 acres of land around Modesto in Stanislaus County. The district has filed on 640 second-feet, but the maximum capacity of the canal at present is less than 600 second-feet.

The principal part of the construction work on this canal was done prior to 1892, but on account of litigation was not finished until April, 1903. A gage-height record has been kept since April 26, 1903, on which date a gage was installed in Indian Hill flume, near Lagrange, Cal. On July 12, 1904, the station was moved to the flume near the intake in order that more gage readings could be made and their fluctuations better interpreted. The gage is an iron staff in a concrete well about 50 feet below the waste gates. Measurements are made from a footbridge at a concrete section about 500 feet below the headworks.

Daily discharges of the Modesto canal have been included with those for Tuolumne River at Lagrange, Cal. The total run-off for the canal for 1907 was 146,000 acre-feet and for 1908 164,000 acre-feet.

Discharge measurements of Modesto canal near Lagrange, Cal., 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 30	W. F. Martin	21.9	83	2.90	538
Do	do	20.2	16	.55	43
Do	do	20.6	27	.92	102
Do	do	20.8	39	1.35	185
Do	do	21.0	46	1.70	257
Do	do	21.2	59	2.12	352
Do	do	21.8	73	2.56	476
1908.					
May 1	W. A. Lamb	22	95	3.05	583
June 16	W. F. Martin	22	96	3.11	576
Do	do	21	59	1.70	296
Do	do	21	40	1.02	152

Daily gage height, in feet, of Modesto canal near Lagrange, Cal., for 1907 and 1908.

[J. W. Simmons, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Dec.
1907.											
1		1.3		0.95	2.2	2.65	2.7	2.75	1.65	0.6	
2		1.3	0.8	.95	2.45	2.65	2.65	2.75	1.6		
3		1.0	1.15	1.5	2.6	2.65	2.7	2.75	1.55		
4		1.0	1.4	1.5	2.4	2.65	2.75	2.75	1.4		
5		1.0	1.4	1.5	2.2	2.65	2.75	2.75	1.4		
6		.4	.65	1.5	2.1	2.6	2.7	.5	1.6		
7		1.5	1.6	1.5	2.1	2.65	2.75	.45	1.6		
8		1.7	2.05	1.5	2.1	2.7	2.75	1.2	1.55		
9		1.9	1.7	1.5	2.2	2.7	2.75	1.2	1.4		
10		2.2	1.1	1.5	2.3	2.7	2.75	.6	1.4		

Daily gage height, in feet, of Modesto canal near Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Dec.
1907.											
11		2.1	0.85	1.5	2.4	2.65	2.75	0.6	1.4		
12		2.15		1.55	2.45	2.6	2.75	.6	1.4		
13		2.4	.9	1.4	1.25	2.65	2.75	.6	1.4		
14		1.6	.9	1.4	.85	2.65	2.75	.6	1.4		
15	0.05	.75	1.45	1.4	2.0	2.7	2.75	1.0	1.35		
16	.05	.5	1.15	1.4	2.2	2.7	2.75	1.0	1.3		
17	.05	1.0	1.1	2.0	2.3	2.7	2.75	1.5	1.25		
18	1.0	1.1	.5	2.4	2.4	2.6	2.75	2.0	1.2		
19	1.0	1.75	.4	2.5	2.4	2.5	2.75	2.35	1.1		
20	1.05	1.75	.4	2.6	2.4	2.3	2.75	2.75	1.1		
21	1.05	1.75	.2	2.4	2.4	2.3	2.75	2.8	1.05		
22		1.0		1.1	1.2	2.3	2.6	2.85	1.0		
23	1.0	.95		1.5	1.1	2.3	2.5	2.85	.95		
24	1.0	.9		1.1	2.4	2.3	2.65	2.8	.95		
25	1.0	.9		2.2	2.5	2.4	2.65	2.7	.95		
26	1.05			2.3	2.55	2.6	2.65	2.8	.9		
27	1.0			2.25	2.55	2.65	2.65	2.5	.9		0.8
28	1.0			2.3	2.6	2.7	2.7	1.9	.9		.85
29	1.0			2.5	2.65	2.7	2.75	1.7	.85		.85
30	1.0			2.35	2.0	2.7	2.75	1.75	.9		.75
31	1.0				2.65		2.75	1.65			.8
1908.											
1	.75	.8	1.8	2.6	2.95	3.0	1.55	1.6	.4		
2	.8	.8	1.8	2.6	2.9	3.1	2.3	1.7	.4		
3	.8	.8	1.8	2.7	2.75	3.1	3.0	1.8	.4		
4	.8	1.0	1.9	2.8	2.7	3.1	2.7	1.8	.4		
5	.8	1.0	2.0	2.8	2.8	3.1	3.1	1.6	.35		
6	.8	1.5	2.1	2.45	2.4	3.05	3.1	1.5	.35		
7	.8	1.5	2.1	.45	2.95	3.1	3.1	1.4	.35		
8	.8	1.6	2.05	.6	3.0	3.1	3.1	1.3			
9	.3	1.4	2.05	.55	3.0	2.95	3.1	1.2			
10	.2	.8	2.05	1.1	3.0	3.05	2.95	1.15			
11	.9	1.35	2.1	1.8	2.05	3.05	2.5	1.1			
12	1.0	1.6	2.1	2.1	1.45	3.05	2.3	1.05			
13	1.3	1.6	2.1	2.3	1.4	3.0	2.5	1.0			
14	1.2	1.6	2.1	1.2	1.45	3.1	2.4	.95			
15		1.6	2.1	2.25	.7	3.05	2.0	.9			
16		1.6	2.1	2.5	1.7	2.9	1.8	.8			
17		1.4	2.15	2.6	2.5	3.1	1.65	.75			
18		1.25	2.15	2.7	2.75	3.05	1.55	.75			
19		1.25	2.15	2.8	2.8	3.1	1.5	.75			
20		1.4	2.1	2.8	2.9	3.05	1.5	.7			
21		1.4	2.1	2.5	3.0	3.1	1.5	.7			
22		1.4	2.2	2.85	3.0	3.1	1.5	.65			
23		1.4	2.3	2.85	3.0	3.1	1.5	.65			
24		1.4	2.3	2.9	3.0	1.7	1.5	.65			
25		1.6	2.4	2.85	3.0	2.7	1.5	.65			
26		1.6	2.4	3.0	2.6	3.1	1.4	.6			.8
27		1.65	2.35	3.0	3.05	3.1	1.35	.55			1.0
28	.35	1.65	2.45	3.0	3.05	3.1	1.5	.55			1.0
29		1.7	2.5	3.0	3.05	8.1	1.6	.5			1.15
30			2.5	3.0	3.1	3.1	1.5	.45			1.4
31			2.6		3.0		1.7	.45			1.5

NOTE.—The canal was dry on days when gage was not read.

Rating tables for Modesto canal near Lagrange, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	2	1.00	117	1.80	280	2.60	475
.30	13	1.10	135	1.90	303	2.70	501
.40	25	1.20	154	2.00	327	2.80	527
.50	38	1.30	174	2.10	351	2.90	553
.60	52	1.40	194	2.20	375	3.00	580
.70	67	1.50	215	2.30	400		
.80	83	1.60	236	2.40	425		
.90	100	1.70	258	2.50	450		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1907 and is well defined.

FOR 1908.

0.00	0	.90	136	1.80	309	2.70	499
.10	13	1.00	154	1.90	330	2.80	521
.20	26	1.10	172	2.00	351	2.90	543
.30	40	1.20	191	2.10	372	3.00	565
.40	55	1.30	210	2.20	393	3.10	587
.50	70	1.40	229	2.30	414	3.20	609
.60	86	1.50	248	2.40	435		
.70	102	1.60	268	2.50	456		
.80	119	1.70	288	2.60	477		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during 1908 and is well defined.

Monthly discharge of Modesto Canal near Lagrange, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	126	0	49.9	3,070
February	425	0	173	9,610
March	339	0	80.8	4,970
April	475	108	272	16,200
May	488	135	377	23,200
June	501	400	472	28,100
July	514	475	505	31,100
August	540	52	310	19,100
September	247	91	165	9,820
October	52	0	1.68	103
November	0	0	0	0
December	91	0	13.6	836
The year	540	0	202	146,000
1908.				
January	210	0	56.4	3,470
February	288	119	224	12,900
March	477	309	384	23,600
April	565	62	431	25,600
May	587	102	483	29,700
June	587	288	568	33,800
July	587	219	368	22,600
August	309	62	153	9,410
September	55	0	12.1	720
October	0	0	0	0
November	0	0	0	0
December	248	0	35.0	2,150
The year	587	0	226	164,000

TURLOCK CANAL NEAR LAGRANGE, CAL.

The Turlock canal, which is owned by the Turlock irrigation district, diverts water through a short tunnel from the left bank of Tuolumne River. The headgates are only a few feet above Lagrange dam. The diverted water is used for irrigating 176,000 acres of fertile land in the vicinity of Turlock and Ceres in Stanislaus County. The district has filed on 1,500 second-feet, but the maximum capacity of the canal at present is somewhat less than 1,000 second-feet.

The first water was turned into the canal in small quantities in 1898 and was used for puddling. A record of the gage height has been kept from July, 1899, to the present time. The gage is a staff float in a concrete well a few feet below the waste gates. Measurements are made in a board flume about one-half mile below the gage well.

Daily discharges of the Turlock canal have been included with those for Tuolumne River at Lagrange. The total run-off for the canal in 1907 was 194,000 acre-feet and in 1908, 204,000 acre-feet.

Discharge measurements of Turlock canal near Lagrange, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 28	W. F. Martin	238	150	5.25	711
May 29	do	238	128	4.50	565
Do	do	238	115	3.98	477
Do	do	238	104	3.50	405
Do	do	238	88	2.92	318
Do	do	238	74	2.30	231
Do	do	238	58	1.75	153
Do	do	238	38	.95	64
1908.					
May 1	W. A. Lamb	24	150	5.4	716
June 16	W. F. Martin	24	157	5.69	748
September 11	W. V. Hardy	24	57	1.47	108

Daily gage height, in feet, of Turlock canal near Lagrange, Cal., for 1907 and 1908.

[H. T. Sackett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1907.										
1			2.8		4.25	5.15	5.1	5.3	3.45	1.95
2			2.8		4.7	5.3	5.1	5.3	4.25	2.45
3			.2		4.8	5.4	5.1	5.3	3.7	2.5
4			.0		4.8	5.4	5.1	5.3	3.55	2.5
5			.0		5.0	5.4	5.1	5.3	3.55	2.35
6			.5		5.1	5.4	5.05	5.4	4.5	2.25
7			.5		5.1	5.4	5.1	5.4	3.8	2.25
8			1.0		5.2	5.35	5.1	5.4	3.6	2.2
9			1.0		5.2	5.4	5.1	5.4	3.55	
10			.0		5.25	5.4	5.1	5.4	3.4	
11			.6		5.3	5.4	5.1	5.4	3.3	
12		2.4	1.15		5.3	5.35	5.1	5.4	3.35	
13		3.6	1.15		5.3	5.3	5.1	5.4	3.4	
14		3.6	1.15		5.3	5.3	5.1	5.4	3.4	
15		3.6	1.15		5.3	5.0	5.1	5.4	3.2	
16		3.6	1.15	0.85	5.15	5.0	5.1	5.4	3.0	
17		2.1	1.15	1.7	5.1	4.7	5.2	5.4	2.85	
18		2.1		1.7	5.1	4.7	5.2	5.4	2.7	
19		2.1		2.15	5.15	4.7	5.2	5.4	2.6	
20		2.1		2.6	5.1	4.7	5.2	5.3	2.5	

Daily gage height, in feet, of Turlock canal near Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1907.										
21	.....	2.1	.....	2.6	5.1	4.7	5.2	5.15	2.3	.....
22	.....	.6	.....	3.0	5.1	4.7	5.2	5.05	2.2	.....
23	.....	.6	.....	3.35	5.1	4.7	5.2	5.0	2.1	.....
24	.....	.6	.....	3.35	.....	4.7	5.3	4.85	2.05	.....
25	.....	2.8	.....	3.35	.....	4.7	5.3	4.45	2.0	.....
26	.....	2.8	.....	3.8	.....	4.7	5.3	4.05	2.0	.....
27	.....	2.8	.....	3.8	.....	5.0	5.3	3.8	2.05	.....
28	.....	2.8	.....	3.8	5.1	5.0	5.3	4.25	2.0	.....
29	.....	.....	.....	4.25	.....	5.0	5.3	4.4	1.9	.....
30	.....	.....	.....	4.25	5.0	5.1	5.3	4.3	2.0	.....
31	.....	.....	.....	.....	5.15	.....	5.3	4.05	.....	.....
1908.										
1	.....	.2	2.2	4.7	5.4	5.5	5.7	3.6	.75	.....
2	.....	.2	2.2	5.0	5.4	5.45	5.7	3.65	.8	.....
3	.....	.2	2.2	5.2	5.35	5.45	5.7	4.5	.75	.....
4	.....	.2	2.2	5.4	5.4	5.45	5.75	4.35	.7	.....
5	.....	.2	2.2	5.5	5.35	5.6	5.7	3.4	.7	.....
6	.....	.2	2.2	5.55	5.4	5.6	5.75	3.05	.65	.....
7	.....	.2	2.2	4.0	5.4	5.6	5.65	2.85	.65	.....
8	.....	.2	2.2	5.65	5.35	6.0	5.6	2.6	.95	.....
9	.....	.2	2.2	5.7	5.35	6.0	5.5	2.4	.95	.....
10	.....	.2	2.2	5.7	5.45	6.0	4.95	2.3	1.3	.....
11	.....	.2	2.2	5.7	5.4	5.55	4.5	2.1	1.5	.....
12	.....	.2	2.2	5.8	5.5	5.5	4.6	2.1	1.3	.....
13	.....	.2	2.2	5.0	5.5	5.55	5.15	2.0	1.2	.....
14	.....	1.2	2.2	5.0	5.5	5.55	4.75	1.9	1.5	.....
15	.....	1.2	2.45	5.0	5.55	5.55	4.25	1.8	.....	.....
16	.....	1.2	2.7	5.05	5.5	5.55	3.95	1.6	.....	.....
17	.....	1.2	2.95	5.1	5.45	5.55	3.75	1.45	.....	.....
18	.....	1.2	3.2	5.2	5.45	5.55	3.65	1.45	.....	.....
19	.....	1.2	3.2	5.2	5.45	5.55	3.4	1.45	.....	.....
20	.....	1.2	3.7	5.3	5.45	5.6	3.45	1.35	.....	.....
21	.....	1.2	3.7	5.3	5.55	5.55	3.45	1.3	.....	.....
22	.....	1.7	3.7	5.3	5.55	5.6	3.1	1.3	.....	.....
23	.....	1.7	3.7	5.25	5.55	5.6	3.05	1.25	.....	.....
24	.....	1.7	3.7	5.3	5.45	5.7	3.05	1.2	.....	.....
25	0.4	1.7	3.7	5.3	5.5	5.7	3.05	1.2	.....	.....
26	.4	1.7	3.95	5.3	5.5	5.7	2.8	1.1	.....	.....
27	.4	1.7	4.2	5.25	5.4	5.7	2.7	1.05	.....	.....
28	.2	2.2	4.45	5.3	5.5	5.7	3.2	1.0	.....	.....
29	.2	2.2	4.7	5.3	5.5	5.7	3.35	.9	.....	.....
30	.2	.....	4.7	5.4	5.5	5.7	3.2	.9	.....	.....
31	.2	.....	4.7	.....	5.4	.....	3.45	.8	.....	.....

NOTE.—The canal was dry on days when gage was not read.

Rating table for Turlock canal near Lagrange, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	1	1.30	100	2.50	255	4.40	555
.20	7	1.40	111	2.60	269	4.60	589
.30	13	1.50	123	2.70	283	4.80	623
.40	19	1.60	135	2.80	298	5.00	657
.50	26	1.70	147	2.90	313	5.20	691
.60	33	1.80	160	3.00	328	5.40	725
.70	41	1.90	173	3.20	358	5.60	760
.80	50	2.00	186	3.40	390	5.80	796
.90	59	2.10	199	3.60	422	6.00	832
1.00	69	2.20	213	3.80	454		
1.10	79	2.30	227	4.00	487		
1.20	89	2.40	241	4.20	521		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made in 1907 and 1908 and is well defined.

Monthly discharge of Turlock Canal near Lagrange, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	0	0	0	0
February	422	0	15.1	839
March	298	0	42.9	2,640
April	539	0	166	9,880
May	708	0	562	34,600
June	725	606	669	39,800
July	708	665	686	42,200
August	725	454	667	41,000
September	530	173	324	19,300
October	255	0	58.8	3,620
November	0	0	0	0
December	0	0	0	0
The year	725	0	266	194,000
1908.				
January	19	0	2.74	168
February	213	7	72.8	4,190
March	606	213	341	21,000
April	796	487	701	41,700
May	751	716	734	45,100
June	832	733	758	45,100
July	787	298	534	32,800
August	572	50	197	12,100
September	123	0	32	1,900
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
The year	832	0	281	204,000

LAGRANGE WATER AND POWER COMPANY'S CANAL NEAR LAGRANGE, CAL.

The Lagrange Water and Power Company's canal takes water from the south side of Tuolumne River at Indian Bar, about 17 miles above the town of Lagrange. This canal was built in the early days to supply water for hydraulic mining in the vicinity of Lagrange, and it is now locally known as the "old mining ditch." Recently it has been thoroughly repaired and is now used as a supply canal for the new hydro-electric plant which was installed in the latter part of 1907. The power house is situated on the bank of the river about half a mile above the town of Lagrange and is below the dam and headworks of the Turlock and Modesto irrigation canals.

The following measurements were made on the power canal during 1907 and 1908, but no regular station was maintained. Gage heights are depths of water in the flume.

Discharge measurements of Lagrange Water and Power Company's canal near Lagrange, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1907.		*Feet.*	*Sec.-ft.*
November 15	W. A. Lamb	0.90	12
1908.			
March 3 [a]	W. F. Martin	.92	11
May 1 [a]	W. A. Lamb	1.35	20
June 16 [b]	W. F. Martin	1.55	35
September 11 [b]	W. V. Hardy		26
December 9 [a]	W. F. Martin	2.24	48

[a] Measurement made in flume opposite dam.
[b] Measurement made in long flume a short distance above reservoir.

The mean daily flow of the canal for 1908, in second-feet, is estimated as follows: January, 10; February, 10; March, 11; April, 20; May, 31; June, 36; July, 35; August, 40; September, 31; October, 35; November, 40; December, 45. From May to September, inclusive, the estimate is fairly accurate, being based on daily gage readings.

STANISLAUS RIVER DRAINAGE BASIN.

DESCRIPTION.

Stanislaus River drains a long, narrow basin lying on the western slope of the Sierra, north of the Tuolumne basin, south of the Calaveras and Mokelumne basins, and west of the Walker River basin, from which it is separated for a distance of about 25 miles by the Sierra divide. The length of the basin from the valley rim to the crest of the divide is about 75 miles; its width averages about 12 miles in the foothills and less than 25 miles near the eastern border. North Fork above and the main stream below form the boundary between Calaveras and Tuolumne counties. The total drainage area above the valley is about 950 square miles.

Stanislaus River has its source in small glacial lakes and on high peaks of the Sierra divide, and flows southwestward to its junction with the lower San Joaquin about 15 miles west of Modesto. It has a total length of about 120 miles, of which about 80 miles is in the mountains and 40 miles in the valley. The main stream is formed by the confluence of its three principal forks heading well back in the mountains. Middle Fork, the largest and most important, unites with North Fork about 12 miles north of Sonora and 30 or 35 miles above the valley rim; South Fork joins the main stream about 8 miles below the junction of North and Middle forks.

The Stanislaus basin shows rough and broken topography. There are many high mountain peaks, more or less barren and precipitous. A few small narrow valleys exist in the upper part of the basin.

Middle Fork courses through a well-developed canyon, 30 or 40 miles long and from 1,500 to 2,000 feet deep. North and South forks also run through canyons from 500 to 1,000 feet deep. Altitudes within the basin range from a few hundred feet in the foothills to 11,000 feet and more at the crest of the divide. The rocks are granitic.

This basin has little timber above the 8,000-foot contour, except at places where glacial lakelets and moraines occur. In the middle reaches of the basin, however, is a great growth of timber. The North Fork basin contains the Calaveras grove of big trees (*Sequoia gigantea*), for which the Sierra is famous. This particular grove is the most northerly group of these trees in the Sierra. The forest cover of the foothill region consists of grass, brush, and scrubby timber. All the upper part of the basin, consisting of about 800 square miles, is included in national forests.

The mean annual precipitation varies with altitude. In the valley, near the border, it is about 15 inches or more, and on the higher elevations 50 or 60 inches. At the high altitudes it occurs chiefly as snow, which lasts well into the summer. The worst floods usually occur in the winter as a result of prolonged storms accompanied by comparatively high temperature.

Opportunities for irrigation in this basin are limited to the San Joaquin Valley, which is traversed by the lower courses of the river for about 40 miles. Water is now being diverted above Knights Ferry, and used for irrigation, chiefly in the vicinity of Oakdale. Further development, however, is feasible.

Some storage development has been effected in the Stanislaus basin, chiefly for mining and power uses. The opportunities for storage in this basin are not, however, very great.

Considerable power is available from the streams in this basin, chiefly Middle and North forks and the main stream below. Development has already been begun. (See Pl. V, *A*.) With the existing fall the minimum flow is sufficient to yield about 80,000 horsepower, and this amount could be increased by storage.

The longest run-off record on Stanislaus River extends back to 1896, with a break for the years 1901 and 1902. The wettest year since that date was 1907 and the driest 1898. The total flow during the wettest year was about eight times that during the driest year.

The only gaging station that has been maintained in this river basin is on Stanislaus River at Knights Ferry, 1895 to 1900, and 1903 to 1908. A gaging station is also being maintained on the Stanislaus Water Company's canal near Knights Ferry, which diverts water past the river station, in order to obtain the total yield of the basin.

STANISLAUS RIVER AT KNIGHTS FERRY, CAL.

A gaging station was first established on this river, May 3, 1895, at the railroad bridge one-half mile north of Oakdale. On July 30, 1898, a cable was placed about 1,000 feet below the railroad bridge, and the station was maintained at this point until February 16, 1901, when it was discontinued.

The present station, which is located at Knights Ferry, about 12 miles northeast of Oakdale, was established May 19, 1903, to obtain general statistical data regarding the flow of the river. The data are useful also in the consideration of irrigation and power projects, and in studying the flood problem on the lower San Joaquin.

No tributaries of importance enter below the station or for many miles above. South Fork joins the main stream about 25 miles above the station.

Numerous diversions from Stanislaus River are made for mining operations, but most of the water is returned to the river. Some water, however, is diverted from the South Fork and turned into the Tuolumne basin. Some water is also diverted from North Fork for use in the vicinity of Murphy and Angels.

The Stanislaus Water Company diverts water about 3 miles above Knights Ferry for power development and also for irrigating land between Knights Ferry and Stockton. The amount used for power is returned to the river through the power house, about 1,000 feet above the gaging station. The developed and acquired water rights probably exceed the low-water flow of the stream.

The conditions for obtaining accurate discharge data at this station are not the best, on account of excessive velocities at high stages and changing conditions of control at low and moderate stages. About 800 feet above the station there is an island which divides the stream into two channels, and a low dam spans each at the head of the island. On the right bank below one of these dams is a power house which operates with water taken from behind the dam, and also from the ditch heading about 3 miles above. The tail water returns to the river, and varies with the load at different hours of the day, thus affecting the gage height somewhat at low stages. The channel section at the station is also subject to slight change, and both banks overflow to some extent in high floods. The position of the gage has been changed, but the datum has remained constant.

Except for the conditions stated above, the records at this station are fairly reliable.

Discharge measurements of Stanislaus River at Knights Ferry, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 15	T. H. Prowse	166	602	7.97	1,710
January 29	do	217	1,060	10.22	5,080
February 3	do	250	1,410	11.22	7,460
March 11	do	225	1,260	10.72	6,110
April 9	do	218	1,240	11.20	6,590
April 23	do	278	1,300	11.60	8,080
May 2	W. F. Martin	230	1,180	11.42	7,620
May 17	T. H. Prowse	294	1,610	12.12	10,200
May 19	do	307	1,810	12.90	12,500
June 2	do	340	2,000	13.55	12,900
June 15	do	188	900	9.62	4,040
June 19	do	208	1,080	10.42	5,740
July 10	do	203	1,070	10.24	5,730
July 15	do	192	927	9.75	4,200
August 2	W. A. Lamb	165	616	8.50	2,180
August 14	T. H. Prowse	130	423	7.10	921
August 21	do	124	333	6.60	604
September 3	do	118	238	6.20	374
September 23	do	111	178	5.70	175
September 28	W. A. Lamb	115	201	5.90	243
November 4	T. H. Prowse	113	163	5.85	251
December 12	do	118	276	6.24	419
1908.					
February 4	T. H. Prowse	127	371	6.65	633
March 5	W. F. Martin	127	339	6.78	653
March 27	T. H. Prowse	138	483	7.55	1,210
April 21	do	191	839	9.73	3,950
April 29	W. A. Lamb	190	816	9.45	3,640
June 15	W. F. Martin	143	494	7.92	1,570
September 8	W. V. Hardy	38	37	5.30	70
October 10	do	39	38	5.30	77
November 26	T. H. Prowse	110	235	5.69	171

Daily gage height, in feet, of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908.

[E. J. Coop, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.4	8.6	8.2	11.15	11.3	12.8	11.2	8.4	6.2	5.7	5.9	5.6
2	7.05	12.55	8.55	11.35	11.45	13.15	10.95	8.35	6.2	5.7	5.85	5.6
3	6.9	11.05	8.3	11.05	11.35	12.9	10.9	8.2	6.2	5.7	5.85	5.6
4	6.95	11.35	8.65	10.9	11.1	12.95	11.0	8.0	6.2	5.7	5.85	5.6
5	7.65	10.8	9.4	10.85	10.7	12.7	11.3	7.9	6.45	5.7	5.85	5.6
6	7.2	9.95	9.2	10.65	10.6	12.25	10.7	7.9	6.4	5.7	5.85	5.6
7	7.2	9.55	8.9	10.6	10.65	11.8	10.55	7.9	6.35	5.7	5.85	6.1
8	8.4	9.25	8.65	10.7	10.6	10.9	10.55	7.8	6.2	5.65	5.75	6.5
9	8.3	9.1	8.75	11.15	11.05	10.9	10.55	7.6	6.1	5.65	5.75	6.1
10	7.9	8.9	14.0	11.4	11.6	11.25	10.3	7.5	6.1	5.65	5.75	6.0
11	7.4	8.8	10.8	11.5	11.8	11.75	10.2	7.35	6.1	5.65	5.75	6.6
12	7.2	8.7	10.1	11.9	11.15	11.9	10.2	7.2	6.1	5.65	5.75	6.3
13	7.3	8.6	9.45	12.25	10.6	10.6	10.15	7.15	6.1	5.65	5.75	6.1
14	8.15	8.55	9.1	12.75	10.5	10.05	9.9	7.15	6.1	5.65	5.7	6.05
15	8.0	8.5	8.85	12.25	11.0	9.8	9.65	7.15	6.05	5.65	5.65	6.05
16	7.4	8.5	8.85	11.7	11.9	9.7	9.4	7.2	6.05	5.65	5.65	6.0
17	7.8	8.75	14.5	11.7	11.85	9.6	9.35	7.15	5.95	5.65	5.65	6.0
18	7.6	8.55	17.35	11.85	12.35	9.85	9.2	7.1	5.9	5.7	5.65	5.9
19	7.25	8.3	25.30	12.15	12.6	10.4	9.4	7.05	5.9	5.7	5.7	5.9
20	7.1	8.25	19.1	12.15	11.75	11.0	9.4	6.85	5.85	5.7	5.7	5.9
21	7.1	8.35	15.6	11.8	11.6	11.3	9.2	6.6	5.8	5.7	5.65	5.9
22	7.1	10.85	14.55	11.85	11.6	11.45	8.9	6.6	5.8	5.8	5.65	5.9
23	7.0	9.5	14.15	12.0	10.75	11.0	8.85	6.6	5.8	5.8	5.65	5.85
24	7.3	8.85	13.8	12.1	10.75	10.45	8.5	6.55	5.75	5.8	5.65	5.8
25	7.5	8.9	14.2	11.85	11.4	10.5	9.1	6.5	5.7	5.85	5.6	5.8
26	7.35	8.8	12.75	11.9	11.5	10.9	9.0	6.45	5.7	5.95	5.65	5.8
27	7.4	8.55	11.8	11.9	11.7	11.2	8.9	6.45	5.75	6.05	5.65	6.75
28	10.95	8.35	11.4	11.9	11.85	11.6	8.9	6.4	5.75	6.0	5.65	6.95
29	10.1	.....	11.1	11.85	12.1	11.9	8.8	6.3	5.7	6.0	5.65	6.55
30	8.95	.....	11.0	11.4	12.3	11.85	8.65	6.3	5.7	6.0	5.6	6.35
31	8.4	.....	11.0	.....	12.7	.....	8.5	6.2	.....	5.9	.....	7.0

Daily gage height, in feet, of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	6.6	6.2	7.25	7.1	9.25	7.9	6.7	6.0	5.3	5.3	5.4	5.4
2	6.4	6.2	7.3	7.0	9.45	7.9	6.65	5.9	5.3	5.3	5.4	5.4
3	6.3	6.35	7.3	7.0	8.95	7.8	6.75	6.0	5.3	5.3	5.35	5.4
4	6.4	6.4	7.0	7.3	8.5	7.5	6.7	5.9	5.3	5.3	5.3	5.5
5	6.2	6.45	6.9	7.7	8.35	7.5	6.75	5.8	5.3	5.3	5.3	5.9
6	6.15	6.3	6.95	7.7	8.55	7.6	6.65	5.8	5.3	5.3	5.35	5.95
7	6.1	6.3	6.7	7.85	8.9	7.7	6.6	5.8	5.3	5.3	5.3	5.7
8	6.1	6.3	6.6	7.55	8.65	8.05	6.55	5.85	5.3	5.3	5.3	5.7
9	6.1	7.5	6.7	7.6	8.2	8.0	6.4	5.7	5.3	5.3	5.35	5.65
10	6.2	7.0	6.85	8.05	7.95	8.2	6.4	5.6	5.35	5.3	5.35	5.65
11	6.1	6.65	6.85	8.7	7.9	7.95	6.45	5.6	5.3	5.3	5.35	5.6
12	6.0	6.45	7.0	9.1	8.15	8.1	6.4	5.6	5.3	5.3	5.35	5.55
13	6.0	6.4	7.1	9.2	8.05	8.1	6.4	5.6	5.3	5.3	5.35	5.55
14	7.6	6.4	7.3	9.5	8.0	8.1	6.35	5.6	5.3	5.3	5.35	5.6
15	6.8	6.3	7.5	9.1	7.95	8.0	6.3	5.45	5.3	5.3	5.4	5.6
16	6.45	6.2	7.7	8.8	7.85	7.8	6.2	5.5	5.3	5.6	5.4	5.5
17	6.4	6.2	7.8	8.45	7.85	7.6	6.15	5.45	5.3	6.1	5.35	5.5
18	6.3	6.2	7.9	8.8	7.75	7.5	5.9	5.5	5.3	5.7	5.35	5.4
19	6.3	6.2	7.8	9.3	8.2	7.35	5.9	5.5	5.3	5.6	5.35	5.45
20	6.25	6.2	7.9	9.55	8.2	7.4	5.9	5.4	5.3	5.45	5.35	5.45
21	6.3	6.15	7.95	9.5	7.95	7.1	5.95	5.45	5.3	5.4	5.35	5.5
22	6.45	6.15	7.85	9.1	8.0	7.0	5.95	5.45	5.3	5.5	5.4	5.5
23	6.7	6.2	7.7	8.65	8.35	7.15	5.95	5.4	5.3	5.4	5.4	5.5
24	6.7	6.1	7.9	8.2	8.4	7.1	5.9	5.3	5.3	5.4	5.85	5.55
25	7.4	6.15	8.1	8.3	8.8	7.0	5.9	5.3	5.3	5.35	5.8	5.4
26	6.6	6.2	7.9	8.35	8.85	7.0	5.9	5.25	5.35	5.3	5.7	5.5
27	6.5	6.45	7.55	8.85	8.6	7.0	5.9	5.25	5.55	5.4	5.6	5.5
28	6.4	6.7	7.35	9.3	8.5	6.9	5.9	5.3	5.3	5.35	5.5	5.5
29	6.4	7.5	7.25	9.4	8.65	6.7	5.9	5.3	5.3	5.4	5.4	5.45
30	6.3	.....	7.25	9.35	8.7	6.7	5.95	5.25	5.3	5.4	5.4	5.45
31	6.25	.....	7.3	.....	8.3	.....	6.2	5.3	.....	5.4	.....	5.5

Rating tables for Stanislaus River at Knights Ferry.

JANUARY 1 TO JULY 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.00	870	8.50	2,310	10.00	4,580	13.00	11,690
7.10	950	8.60	2,430	10.20	4,950	14.00	14,600
7.20	1,030	8.70	2,550	10.40	5,330	15.00	17,800
7.30	1,110	8.80	2,670	10.60	5,730	16.00	21,200
7.40	1,190	8.90	2,800	10.80	6,150	17.00	24,700
7.50	1,270	9.00	2,930	11.00	6,590	18.00	28,400
7.60	1,360	9.10	3,070	11.20	7,050	19.00	32,300
7.70	1,450	9.20	3,220	11.40	7,520	20.00	36,200
7.80	1,540	9.30	3,370	11,60	8,000	21.00	40,100
7.90	1,640	9.40	3,530	11.80	8,500	22.00	44,000
8.00	1,740	9.50	3,700	12.00	9,000	23.00	48,000
8.10	1,850	9.60	3,870	12.20	9,510	24.00	52,000
8.20	1,960	9.70	4,040	12.40	10,030	25.00	56,000
8.30	2,070	9.80	4,220	12.60	10,570	26.00	60,000
8.40	2,190	9.90	4,400	12.80	11,120		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is fairly well defined between gage heights 7 feet and 13.5 feet. Above gage height 22 feet the rating curve is a tangent, the difference being 400 per tenth. Below 9 feet it is the same as the 1906 table.

Rating tables for Stanislaus River at Knights Ferry—Continued.

AUGUST 1, 1907, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.20	50	6.30	415	7.40	1,110	8.50	2,230
5.30	70	6.40	470	7.50	1,190	8.60	2,350
5.40	95	6.50	525	7.60	1,280	8.70	2,480
5.50	120	6.60	580	7.70	1,370	8.80	2,610
5.60	145	6.70	640	7.80	1,470	8.90	2,740
5.70	175	6.80	700	7.90	1,570	9.00	2,880
5.80	205	6.90	760	8.00	1,670	9.20	3,160
5.90	240	7.00	820	8.10	1,780	9.40	3,460
6.00	280	7.10	890	8.20	1,890	9.60	3,760
6.10	320	7.20	960	8.30	2,000		
6.20	365	7.30	1,030	8.40	2,110		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 17 discharge measurements made during 1907 and 1908 and is well defined. Above 9.5 feet it is the same as the 1906 table.

Monthly discharge of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908.

[Drainage area, 935 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	6,520	820	1,640	1.75	2.02	101,000	B.
February	10,500	2,020	3,560	3.81	3.97	198,000	B.
March	57,200	1,980	10,400	11.12	12.82	640,000	B.
April	11,000	5,740	8,110	8.67	9.67	483,000	C.
May	10,900	5,590	7,690	8.22	9.48	473,000	C.
June	12,200	3,970	7,500	8.02	8.95	446,000	C.
July	7,380	2,420	4,370	4.67	5.38	269,000	C.
August	2,220	453	1,070	1.14	1.31	65,800	B.
September	585	263	378	.404	.45	22,500	B.
October	374	241	274	.293	.34	16,800	B.
November	278	166	206	.220	.25	12,300	B.
December	840	169	353	.378	.44	21,700	B.
The year	57,200	166	3,800	4.06	55.08	2,750,000	
1908.							
January	2,000	305	522	.558	.64	32,100	A.
February	1,220	345	518	.554	.60	29,800	A.
March	1,830	605	1,160	1.24	1.43	71,300	A.
April	3,770	897	2,390	2.56	2.86	142,000	A.
May	3,630	1,530	2,220	2.37	2.73	136,000	A.
June	2,010	728	1,360	1.45	1.62	80,900	A.
July	780	354	501	.536	.62	30,800	A.
August	361	116	208	.222	.26	12,800	A.
September	148	95	117	.125	.14	6,960	A.
October	334	83	126	.135	.16	7,750	A.
November	239	84	121	.129	.14	7,200	A.
December	277	102	155	.166	.19	9,530	A.
The year	3,770	83	783	.837	11.39	567,000	

NOTE.—Values are rated lower for April to July, 1907, because measurements in this period give discharges in excess of rating, probably due to excessively high surface velocity.

This estimate includes the flow of the power canal and Schell ditch. For the latter, a mean flow of 7 second-feet was assumed.

STANISLAUS WATER COMPANY'S CANAL AT KNIGHTS FERRY, CAL.

This canal diverts water from the right bank of Stanislaus River at a point about 3 miles above Knights Ferry. At some distance below the intake Schell ditch diverts a small quantity of water from

the main canal for irrigation. The flow in the ditch is about 7 second-feet and is assumed to be constant. About one-half mile above Knights Ferry is another diversion from the main canal through a pressure pipe to the power house on the bank of the river, and the water thus diverted is used for power and then returned to the river about 1,000 feet above the gaging station.

This station, which is on the Oakdale road about one-half mile from Knights Ferry and about 200 feet below the point where the canal passes under the flume of Schell ditch, was established June 11, 1904, for the purpose of determining the amount of water diverted above the station on the river and used for irrigation. The station is on the main canal below all diversions.

Daily discharges of the canal have been included in those for Stanislaus River at Knights Ferry, Cal. The total run-off for the canal in 1907 was 34,200 acre-feet, and in 1908, 35,100 acre-feet.

The following measurements were made on Schell ditch, 200 feet below the intake, in 1908:

September 8, 6.6 second-feet.
October 10, 2.7 second-feet.

Discharge measurements of Stanislaus Water Company's canal at Knights Ferry, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	W. A. Lamb	9	21	2.85	72
June 15	W. F. Martin	8.7	25	3.40	102
September 8	W. V. Hardy	9	11	1.92	20
October 10	do	8	4.2	1.04	2.7

Daily gage height, in feet, of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908.

[T. T. Burt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.2	2.15	1.8	.....	1.5	3.2	3.3	3.35	2.9	3.1	2.6	2.05
2	2.15	2.15	2.15	.....	1.7	2.2	3.4	3.4	3.0	3.0	2.6	1.8
3	1.85	2.2	2.35	.....	2.35	2.3	2.55	3.35	2.8	3.2	2.45	2.0
4	1.8	2.15	1.95	.....	1.85	2.25	3.35	3.4	3.0	3.2	1.85	2.0
5	2.15	1.9	1.95	.....	2.25	2.2	3.35	3.35	3.1	3.0	1.85	2.0
6	2.15	2.0	2.2	.....	2.45	2.3	3.4	3.35	3.1	3.2	1.65	2.0
7	1.9	2.0	1.95	.....	2.45	2.25	3.35	3.1	3.1	3.2	1.65	2.2
8	1.95	1.7	2.2	.....	1.15	2.25	3.4	2.95	3.25	3.1	1.45	1.55
9	1.8	1.7	2.35	.....	.....	3.3	3.4	2.95	3.2	3.1	2.2	1.45
10	2.1	1.95	2.4	2.8	.....	3.3	3.3	2.95	3.2	3.1	1.5	1.55
11	1.65	1.7	2.25	1.8	2.5	3.3	3.4	.....	3.2	3.1	1.55	1.65
12	1.65	1.7	2.45	1.9	2.7	3.3	3.2	.....	3.2	3.2	1.6	1.45
13	2.15	1.8	2.4	2.25	2.1	3.25	3.4	.....	3.2	3.3	1.65	1.65
14	2.1	1.8	2.45	2.25	2.7	3.15	3.35	.....	3.2	3.2	1.45	1.55
15	2.0	1.7	2.4	2.2	2.55	3.3	3.3	.....	3.35	3.0	1.5	2.45
16	2.0	1.7	2.6	2.5	2.75	3.3	3.3	2.2	3.2	3.0	1.6	1.85
17	2.05	1.65	2.2	1.7	2.65	3.25	3.3	2.25	3.2	3.0	1.65	1.85
18	1.95	.....	2.05	2.35	2.75	3.25	3.25	2.6	3.2	3.0	1.65	1.5
19	2.0	.....	3.45	1.1	2.8	3.3	3.2	2.85	3.2	2.9	1.5	1.45
20	2.3	.....	.....	.....	2.6	3.25	3.3	3.1	3.2	2.9	1.5	2.25

Daily gage height, in feet, of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	2.1	.....	.....	.....	2.7	3.25	3.35	2.95	3.2	2.95	1.45	1.45
22	2.2	.....	.....	1.5	2.9	3.25	3.4	3.0	3.2	2.85	1.55	2.25
23	2.1	.....	.....	2.35	2.95	3.4	3.35	2.9	3.2	2.85	1.65	1.5
24	1.9	.....	.....	2.45	2.9	3.35	3.4	3.2	3.2	2.85	1.65	1.85
25	2.15	.....	.....	2.6	2.8	3.4	3.35	3.3	3.1	2.85	1.65	1.95
26	1.9	.....	.....	2.65	3.1	3.4	3.4	3.1	3.2	2.75	1.65	2.35
27	2.1	.....	.....	2.6	3.15	3.4	3.35	3.2	3.25	2.9	1.6	2.2
28	2.2	.....	.....	.....	3.2	3.35	2.5	3.1	3.1	2.9	1.6	2.2
29	2.2	.....	.....	1.95	3.2	3.3	3.3	3.1	3.25	2.7	1.65	2.45
30	1.7	.....	.....	.75	3.2	3.4	3.4	3.2	3.15	2.6	1.65	1.45
31	2.05	.....	.....	.....	3.2	.....	3.35	3.1	.....	2.6	.....	1.45
1908.												
1	2.0	1.45	1.45	2.95	3.2	3.45	3.3	3.0	2.55	1.4	2.65	1.45
2	1.95	2.35	1.45	2.95	3.2	3.45	3.4	2.65	2.5	1.3	2.65	1.45
3	1.85	2.35	1.45	2.95	3.4	3.45	3.5	2.65	2.45	1.35	2.7	1.45
4	1.85	1.85	1.5	2.95	3.2	3.4	3.5	2.6	2.0	1.3	1.3	1.45
5	2.45	1.85	1.5	3.0	3.1	3.4	3.4	2.75	2.0	1.3	1.3	1.45
6	2.35	1.95	1.5	3.0	3.1	3.5	3.4	2.75	2.45	1.3	1.3	1.45
7	2.35	1.45	1.5	3.1	3.2	3.55	3.4	2.75	2.45	1.3	1.3	1.45
8	2.35	1.85	1.85	3.3	3.2	3.55	3.4	2.75	1.45	1.3	1.3	1.45
9	2.35	1.95	1.85	.....	3.2	3.55	3.4	3.15	2.65	1.3	1.3	1.45
10	1.95	2.2	1.85	.....	3.3	3.55	3.45	3.1	2.75	1.3	1.3	1.45
11	1.85	2.2	1.45	.....	3.3	3.55	3.4	2.9	2.8	1.3	1.3	1.45
12	1.85	2.2	1.85	.....	3.4	3.55	3.4	2.9	2.65	1.3	1.3	1.45
13	1.85	2.35	1.85	2.9	3.35	3.55	3.4	2.9	2.55	1.3	1.3	2.35
14	1.85	2.35	1.85	2.9	3.4	3.55	3.45	2.9	2.55	1.25	1.3	2.35
15	2.35	2.2	1.85	2.95	3.4	3.6	3.5	2.9	2.65	1.25	1.4	2.35
16	2.35	2.35	1.85	2.95	3.4	3.6	3.5	3.1	2.7	1.3	1.4	2.25
17	2.35	2.35	1.45	3.0	3.4	3.5	3.5	3.15	2.65	1.3	1.3	2.25
18	2.35	2.35	1.45	3.0	3.4	3.5	3.45	3.05	2.65	1.85	1.4	2.25
19	1.85	2.35	1.5	2.7	3.35	3.5	3.1	2.9	2.75	2.4	1.85	2.25
20	1.85	2.35	1.5	3.0	3.3	3.5	3.1	2.85	2.4	2.4	1.85	2.45
21	1.85	1.85	1.5	3.0	3.3	.....	3.0	2.85	2.4	2.4	1.85	2.5
22	1.45	1.85	2.2	3.1	3.35	3.6	3.0	2.85	2.45	2.4	1.45	2.5
23	1.45	1.85	2.2	3.25	3.4	.....	2.9	2.7	1.95	2.4	1.45	.....
24	1.85	1.85	2.35	3.2	3.35	3.0	3.0	2.7	1.85	2.45	1.45	.....
25	2.2	1.95	2.45	3.2	3.35	3.2	3.0	2.7	1.85	2.6	1.45	.....
26	2.35	1.65	2.45	3.2	3.35	3.2	2.9	2.7	1.85	2.6	1.45	.....
27	2.35	1.65	2.5	3.2	3.35	3.2	2.9	2.65	1.4	2.65	1.95	.....
28	2.45	1.65	2.6	3.2	3.3	3.2	2.9	2.7	1.4	2.65	1.95	.....
29	2.35	1.5	2.55	3.2	3.3	3.1	2.9	2.7	1.3	2.65	1.95	.....
30	1.45	.....	2.6	3.25	3.3	3.1	2.9	2.6	1.3	2.6	1.45	.....
31	1.45	.....	2.7	.....	3.35	.....	2.9	2.6	.....	2.6	.....	.....

NOTE.—The canal was dry on days that have no gage record.

Rating table for Stanislaus Water Company's canal at Knights Ferry, Cal., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	0	1.60	13	2.50	44	3.30	95
.80	.7	1.70	15	2.60	49	3.40	103
.90	1.5	1.80	17	2.70	54	3.50	111
1.00	2.5	1.90	20	2.80	60	3.60	119
1.10	4.0	2.00	23	2.90	67	3.70	127
1.20	5.5	2.10	27	3.00	74	3.80	135
1.30	7	2.20	31	3.10	81	3.90	143
1.40	9	2.30	35	3.20	88	4.00	151
1.50	11	2.40	39				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1905–1908 and is fairly well defined.

Monthly discharge of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	35	14	24.4	1,500
February	31	0	12.3	683
March	107	0	22.2	1,360
April	60	0	18.4	1,090
May	88	0	49.5	3,040
June	103	31	80.7	4,800
July	103	44	94.9	5,840
August	103	0	65.9	4,050
September	99	60	84.8	5,050
October	95	49	73.3	4,510
November	49	10	17.0	1,010
December	41	10	20.4	1,250
The year	107	0	47.0	34,200
1908.				
January	42	10	26.1	1,600
February	37	10	24.9	1,430
March	54	10	22.8	1,400
April	95	0	67.4	4,010
May	103	81	95.8	5,890
June	119	0	98.2	5,840
July	111	67	91.1	5,600
August	84	49	62.3	3,830
September	60	7	37.1	2,210
October	52	6	23.5	1,440
November	54	7	15.0	893
December	44	0	15.9	978
The year	119	0	48.3	35,100

CALAVERAS RIVER DRAINAGE BASIN.

DESCRIPTION.

Calaveras River drains a triangular, wedge-shaped area on the western slope of the Sierra, north of the Stanislaus basin and south of the Mokelumne basin. The basin has a width of from 12 to 16 miles in the foothills, and a length of about 45 miles from the rim of San Joaquin Valley to its apex in the mountains. Its total area above the border of San Joaquin Valley is about 500 square miles.

Calaveras River is formed by the confluence of North and South forks near San Andreas. The stream has its source in creeks at an altitude of 4,000 to 5,000 feet, and flows southwestward to its junction with the lower San Joaquin, a few miles west of Stockton. Its total length is about 80 miles, of which 35 miles are in the valley and 45 miles in the mountains.

This basin is almost wholly a foothill region. The hills are generally low, and are separated by small, irregular valleys here and there. The highest point in the basin is 6,000 feet in altitude, but only a very small part exceeds 4,000 feet. In the upper part of the basin the topography is more regular, and is characterized by rough, parallel ridges separated by canyons several hundred feet deep through which the small creeks flow. The formation has a granitic base.

In the lower foothills the forest cover consists of grass, brush, and scrubby timber, chiefly oak; but in the upper part of the basin there is a thick growth of timber. The Calaveras grove of big trees (*Sequoia gigantea*) is partly in this basin and partly in the Stanislaus basin to the south. This is the most northern grove of these gigantic trees in the Sierra.

The mean annual precipitation varies with altitude. It is about 15 inches in the valley, about 22 inches in the low foothills, and 35 or 40 inches in the upper part of the basin. The very little snow that falls in this basin quickly disappears.

Calaveras River is torrential in winter and dry for a few months during the summer. It is, therefore, not especially suitable for irrigation without storage. Some storage development on a small scale has already been accomplished, but further achievement is possible. Without storage very little power can be obtained, especially during the summer and fall.

The only gaging station which has been maintained in this basin is on the Calaveras River at Jenny Lind (1907 to 1908).

CALAVERAS RIVER AT JENNY LIND, CAL.

This station, which is located at the wagon bridge on the Milton road, about one-fourth mile from Jenny Lind post-office, was established December 1, 1906, by the United States Weather Bureau, and has been rated by the Geological Survey to obtain general statistical information regarding the flow of Calaveras River. The data are useful also in the development of irrigation and power projects and in studying the general flood problem in the lower San Joaquin; but they are of the greatest immediate value in devising protective measures against the flooding of the city of Stockton during the winter.

The station is well up in the foothills, and there are a few small intermittent tributaries below. Cosgrove, Slate, and Bear creeks enter about 5 miles above the station. North and South forks unite about 15 miles above.

No diversions are made immediately above the station. The acquired water rights are for mining and power operations.

The conditions for obtaining accurate discharge data are not very good. At low stages the stream at the station is about 100 feet wide and 2 feet deep, and the current is very sluggish. A considerable change in flow makes very little difference in the gage height, so that more or less error arises from the fact that the gage record is only to tenths of feet. At low stages measurements can be made at other sections by wading, thus eliminating inaccuracies from that source. At flood stages the current is very swift and the channel may change slightly. The upper part of the curve has been determined from slope and cross section. The gage datum has remained constant.

The records of flow are fairly reliable and satisfactory, except for the conditions stated above.

Discharge measurements of Calaveras River at Jenny Lind, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	W. G. Steward	130	424	1.70	576
September 30	W. A. Lamb	22	14	.19	26
November 4	do	24	17	.35	41
1908.					
January 8	W. A. Lamb	105	289	.63	85
April 14	do	44	36	.50	68
December 11	W. F. Martin	34	20	.30	40

NOTE.—River entirely dry from July 15 until after September 15, 1908.

Daily gage height, in feet, of Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

[United States Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1907.								
1	2.4	2.7	2.2	2.5	1.4	0.9	.....	0.3
2	2.2	5.0	2.2	2.5	1.4	.9	.....	.3
3	1.8	4.6	2.2	2.1	1.4	.9	.....	.3
4	1.8	4.2	2.1	2.1	1.4	.9	.....	.3
5	3.2	3.6	3.6	2.1	1.4	.9	.....	.4
6	2.2	3.0	3.0	2.1	1.4	.9	.....	.4
7	2.2	2.7	2.6	2.1	1.4	.9	.....	.6
8	2.7	2.6	2.6	2.0	1.4	.9	.....	.8
9	3.8	2.6	2.6	2.0	1.2	.9	.....	.8
10	3.3	2.6	6.6	1.9	1.2	.9	.....	.8
11	2.6	2.6	5.6	1.9	1.2	1.0	.....	1.0
12	2.3	2.0	4.6	1.9	1.2	1.0	.....	.9
13	2.3	2.0	4.6	1.9	1.2	1.0	.....	1.0
14	3.0	2.0	3.2	1.9	1.0	1.0	.....	1.0
15	3.3	1.8	2.8	2.1	1.0	1.0	.....	.8
16	2.7	1.8	2.8	2.0	1.0	1.0	.....	.6
17	2.5	1.9	6.6	1.8	1.0	1.0	.....	.6
18	3.2	1.8	4.3	1.8	1.0	1.0	.....	.6
19	3.2	1.8	11.4	1.7	1.0	.8	.....	.6
20	2.4	1.8	5.0	1.7	1.0	.8	.....	.7
21	2.4	1.8	5.0	1.7	1.0	.8	.....	.6
22	2.3	4.8	5.0	1.6	1.0	.8	.....	.6
23	2.2	3.2	5.0	1.6	1.1	.8	.....	.6
24	2.2	2.3	5.0	1.5	1.0	.8	.....	.6
25	2.2	3.2	5.0	1.5	1.0	.8	.....	.6
26	2.2	2.4	4.0	1.5	1.0	.8	.....	.6
27	2.2	2.4	3.3	1.5	1.0	.8	.....	.7
28	2.4	2.2	3.0	1.5	1.0	.8	.....	.7
29	3.1	.....	3.0	1.4	1.0	.8	.....	.9
30	3.3	.....	2.5	1.4	.9	.8	.....	.9
31	2.7	.....	2.5	.....	.9	.....	.....	1.1
1908.								
1	1.1	.9	1.0	.9	.5	.3	0.2	.2
2	1.1	.9	1.2	.9	.5	.3	.2	.2
3	1.1	1.0	2.0	.9	.4	.3	.2	.2
4	1.2	1.1	1.6	.9	.4	.3	.2	.2
5	1.0	1.1	1.5	.9	.4	.3	.2	.4
6	1.0	1.0	1.3	.9	.4	.3	.2	.9
7	1.0	.9	1.2	.8	.4	.3	.2	.9
8	1.0	.9	1.0	.8	.4	.3	.2	.9
9	1.0	2.2	1.0	.8	.4	.3	.2	.9
10	1.0	3.0	1.0	.8	.4	.3	.2	1.1

Daily gage height, in feet, of Calaveras River at Jenny Lind, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1908.								
11	1.0	1.4	0.9	0.8	0.4	0.3	0.2	01.0
12	1.0	1.4	.9	.8	.4	.3	.2	1.0
13	.7	1.2	.9	.8	.4	.3	.2	1.0
14	2.9	1.0	.9	.8	.4	.3	.2	.5
15	1.5	.9	.9	.5	.4	.3	.2	.5
16	1.5	.8	.9	.5	.4	.3	.2	.5
17	1.2	.8	.9	.5	.4	.3	.2	.5
18	1.2	.8	.9	.5	.4	.3	.2	.6
19	1.2	.8	.8	.5	.4	.3	.2	.5
20	1.2	.8	.8	.5	.4	.3	.2	.5
21	1.3	.8	.8	.5	.4	.3	.2	.5
22	1.3	.8	.8	.6	.4	.3	.2	.5
23	1.3	.7	.8	.6	.4	.3	.2	.5
24	1.8	.7	.9	.6	.4	.3	.2	.5
25	2.0	.7	.9	.5	.5	.3	.2	.5
26	1.4	.7	.9	.5	.5	.3	.2	.5
27	1.3	.7	.9	.5	.5	.3	.2	.5
28	1.2	.7	.9	.5	.5	.3	.2	.5
29	1.2	.8	.9	.5	.5	.3	.2	.5
30	1.0	.....	.9	.5	.4	.3	.2	.5
31	.9	.....	.9	.....	.3	.....	.....	.5

NOTE.—The river was entirely dry from July 15 to some time after September 15, 1908.

Rating table for Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	18	1.30	380	2.60	1,500	4.80	4,720
.10	22	1.40	440	2.70	1,610	5.00	5,100
.20	28	1.50	500	2.80	1,730	5.20	5,500
.30	37	1.60	570	2.90	1,850	5.40	5,920
.40	50	1.70	640	3.00	1,980	5.60	6,360
.50	66	1.80	720	3.20	2,240	5.80	6,800
.60	86	1.90	810	3.40	2,510	6.00	7,250
.70	111	2.00	900	3.60	2,800	7.00	9,800
.80	141	2.10	990	3.80	3,100	8.00	12,750
.90	177	2.20	1,090	4.00	3,400	9.00	16,100
1.00	220	2.30	1,190	4.20	3,720	10.00	20,000
1.10	270	2.40	1,290	4.40	4,040	11.00	24,200
1.20	325	2.50	1,390	4.60	4,370	12.00	29,000

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made in 1907 and 1908, and is fairly well defined between gage heights 0.2 foot and 1.7 feet. Above gage height 3 feet it is based on slope data.

Monthly discharge of Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

[Drainage area, 395 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.						
January	3,100	720	1,540	3.90	4.50	94,700
February	5,100	720	1,750	4.43	4.61	97,200
March	26,100	990	4,030	10.2	11.76	248,000
April	1,390	440	778	1.97	2.20	46,300
May	440	177	293	.742	.86	18,000
June	220	141	174	.441	.49	10,400
December	270	37	115	.291	.34	7,070
The period						522,000
1908.						
January	1,850	111	380	.962	1.11	23,400
February	1,980	111	281	.711	.77	16,200
March	900	141	239	.605	.70	14,700
April	177	66	110	.278	.31	6,550
May	66	37	53.2	.135	.16	3,270
June	37	37	37.0	.094	.10	2,200
November	28	28	28	.071	.08	1,670
December	270	28	97	.246	.28	5,960
The period						74,000

NOTE.—These discharges are only fairly reliable as the gage height record is poor. Discharges of over 1,000 second-feet are only approximate on account of lack of high water measurements. The flow was small during the period of missing records, the river going entirely dry in midsummer.

MOKELUMNE RIVER DRAINAGE BASIN.

DESCRIPTION.

The Mokelumne River basin lies on the western slope of the Sierra, north of the Calaveras and Stanislaus river basins, and south of the Cosumnes and American River basins. For a distance of about 20 miles it touches the Sierra divide, which separates it from the Walker River basin on the east. Strictly speaking, the area drained by Cosumnes River and several other small tributaries which enter many miles west of the valley border, should be considered as a part of the Mokelumne basin; but this area is excluded from this description because it contributes nothing to the flow of Mokelumne River above the lower Sacramento and San Joaquin delta region. As thus limited, the Mokelumne basin is a long, narrow area, in profile very much like a long-necked circular bottle, with its mouth opening into the valley and its base resting on the crest of the Sierra. Its total length is about 75 miles half neck and half body. The neck averages about 3 miles in width and the body about 14 miles. The total area of the basin above the valley rim is about 640 square miles.

Mokelumne River has its source in glacial lakelets in Alpine County at an altitude of nearly 10,000 feet above sea level, and flows southwestward to its junction with the lower San Joaquin, about 25 miles

northwest of Stockton. It has a total length of about 140 miles, of which approximately 90 miles are in the mountains. For the greater part of its course it forms the boundary between Amador County on the north and Calaveras County on the south. The principal branches are North, Middle, and South forks, which unite about 5 miles above Electra and nearly 40 miles above the rim of the valley, at the point where the basin begins to contract into the narrow neck characteristic of its lower part. Bear River is tributary to North Fork from the north.

The topography of this basin presents considerable variety. The lower, narrow part is a rolling, hilly region, sloping toward the river from each side and having large cultivated areas. Farther upstream the slopes become greater, and the river appears in a broad, shallow canyon that increases in depth on the main stream almost to its source. Above the confluence of the forks the topography is more pronounced and regular, and is characterized by parallel ridges separated by canyons. In the upper part of the basin there are small lakes and valleys surrounded by high peaks. Altitudes range from 200 feet in the foothills to 10,000 on the crest of the divide. The formation is granitic.

On the middle and higher elevations of the Mokelumne basin is a heavy timber growth. Grass, brush, and scattering oaks cover the lower reaches. All the upper part of the basin, amounting to about 400 square miles, is inclosed in national forests.

The mean annual precipitation varies with altitude. It is about 20 inches in the valley, 25 or 30 inches in the foothills, and 50 inches or more on the higher elevations, where most of it occurs as snow. Flood conditions in this basin during the winter and spring months are usually less severe than in adjacent basins, because of the fact that such a large percentage of the catchment area is at a high altitude and receives only snowfall.

Opportunities for irrigation in this basin are confined chiefly to the bottom lands in the foothills and to the valley lands below. Some attempts on a moderately large scale have been made to utilize the stream, but as a rule they have not been successful. Except for local development along the river the stream is little used for irrigation.

Some artificial storage exists in this basin, but not on a large scale. Further development is feasible, especially in the upper part of the basin.

The streams have steep gradients, and the minimum flow is sufficient to furnish considerable power without storage. An important amount has already been developed.

The longest run-off record in this basin dates back to 1904. The wettest year since that time was 1907 and the driest 1908. The total

flow during the wettest year was nearly four times that during the driest.

The only gaging station maintained in this basin is on Mokelumne River near Clements, 1904 to 1908.

MOKELUMNE RIVER NEAR CLEMENTS, CAL.

This station, which is located at the highway bridge about 1 mile north of Clements, was established October 28, 1904, for the purpose of obtaining general statistical information regarding the flow of this river. The data are valuable also in constructing projects for irrigation and power and in studying the flood problem of the San Joaquin and Sacramento valleys.

No important tributaries enter for many miles above or below the station. The three forks unite about 30 miles above Clements, and Cosumnes River enters from the north about 30 miles below Clements.

Several ditches take water for use in mining and in power development in the Mokelumne basin, but most of the water is returned to the river. No diversions are made immediately above the station, except for local irrigation on the bottom lands adjacent to the river. In the upper part of the basin some water is probably diverted into contiguous basins. The acquired water rights on the lower part of the stream probably take the larger part, if not all, of the minimum flow.

The bed of the stream at the station is composed of sand and fine gravel and is subject to slight change. The gage datum has remained constant. The records at this station are fairly satisfactory.

During the extreme flood beginning March 19, 1907, the station was destroyed, and the gage heights for the high-water period, March 19 to April 10, 1907, have been estimated.

Discharge measurements of Mokelumne River near Clements, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 6	R. S. Hawley	253	1,270	9.40	3,760
February 19	do	255	681	6.87	1,680
March 6	do	255	778	7.24	2,140
March 13	do	255	851	7.53	2,380
October 2	W. A. Lamb	100	217	4.43	280
November 6	do	88	200	4.32	278
1908.					
April 16	W. A. Lamb	263	746	6.95	1,860
April 28	do	268	1,230	8.55	3,400
September 16	W. V. Hardy	85	133	3.74	143
October 8	do	79	110	3.56	122
December 12	W. F. Martin	82	148	3.95	210

Daily gage height, in feet, of Mokelumne River near Clements, Cal., for 1907 and 1908.

[Reba Gaskill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.7	7.65	6.45	a10.4	9.55	12.45	11.0	6.65	4.4	4.3	4.25	4.25
2	5.75	13.55	6.65	a10.3	9.55	12.65	10.4	6.4	4.35	4.35	4.2	4.2
3	5.15	11.55	6.55	a10.2	9.8	12.35	10.55	6.3	4.35	4.4	4.25	4.05
4	6.15	12.1	6.85	a10.0	9.4	12.35	10.95	6.0	4.5	4.45	4.2	4.25
5	6.1	10.95	7.65	a9.9	8.6	12.15	10.85	5.8	4.5	4.55	4.25	4.25
6	5.35	9.45	7.25	a9.7	8.55	11.55	10.2	5.8	4.6	4.35	4.25	4.25
7	5.25	8.8	6.9	a9.6	8.15	11.2	10.05	5.7	4.3	4.25	4.35	4.45
8	6.45	8.3	6.8	a9.4	8.45	9.55	10.6	5.55	4.35	4.25	4.2	4.8
9	6.65	8.05	7.5	a9.3	9.25	9.8	10.15	5.55	4.1	4.35	4.35	4.3
10	5.75	7.95	9.7	9.1	10.25	10.3	9.85	5.5	4.2	4.35	4.25	4.3
11	5.20	7.7	9.0	9.5	10.15	11.5	9.7	5.25	4.25	4.35	4.15	4.95
12	4.95	7.55	8.0	9.85	9.55	9.85	9.75	5.25	4.1	4.25	4.25	4.8
13	5.1	7.3	7.55	10.35	8.6	9.05	9.4	5.15	4.1	4.25	4.35	4.25
14	6.55	7.15	7.25	10.95	8.45	8.35	8.9	5.15	4.3	4.2	4.25	4.45
15	5.6	7.05	7.05	10.8	9.25	7.9	8.55	5.0	4.2	4.25	4.35	4.55
16	5.1	7.0	7.15	10.05	10.0	7.8	8.25	5.0	4.2	4.35	4.15	4.3
17	5.3	7.25	13.6	9.85	10.65	7.9	8.2	5.05	4.25	4.35	4.25	4.3
18	5.4	7.05	17.0	9.95	11.45	8.25	8.1	4.9	4.25	4.3	4.25	4.4
19	5.3	6.85	21.0	10.6	11.5	9.35	8.1	4.9	4.25	4.35	4.15	4.2
20	4.9	6.8	a17.9	10.8	9.8	10.4	8.2	4.8	4.3	4.2	4.15	4.3
21	4.85	6.75	a15.9	10.15	10.05	10.9	7.9	4.7	4.25	4.25	4.15	4.25
22	4.9	6.85	a13.0	10.3	10.1	11.1	7.35	4.7	4.3	4.35	4.25	4.2
23	4.9	7.35	a13.3	10.6	9.5	9.9	7.35	4.5	4.25	4.25	4.25	4.2
24	4.95	7.1	a13.0	10.4	9.45	8.95	7.45	4.45	4.2	4.35	4.25	4.2
25	5.55	7.25	a11.6	10.3	9.35	9.15	7.65	4.55	4.3	4.45	3.95	4.25
26	5.9	7.05	a11.2	10.35	9.45	a10.0	7.4	4.4	4.2	4.5	4.25	4.2
27	5.5	6.8	a11.1	10.25	9.5	10.8	7.05	4.35	4.3	4.55	4.25	5.05
28	9.65	6.55	a11.0	10.2	11.0	11.25	7.3	4.5	4.3	4.35	4.25	5.3
29	8.75	.....	a10.8	9.95	11.4	11.6	7.35	4.4	4.45	4.25	4.25	4.9
30	7.15	.....	a10.7	9.65	11.7	11.6	7.05	4.4	4.2	4.25	4.25	4.6
31	6.9	.....	a10.5	.....	12.3	.....	6.75	4.7	.....	4.35	.....	5.1
1908.												
1	4.9	4.35	5.0	5.2	8.0	6.55	4.8	3.5	3.45	3.65	3.8	3.85
2	4.6	4.4	5.1	5.15	8.0	6.6	4.8	3.6	3.65	3.75	3.65	3.8
3	4.5	4.6	5.3	5.1	7.1	6.3	4.65	3.5	3.65	3.6	3.6	3.9
4	4.75	4.7	5.3	5.15	6.75	6.2	4.5	3.6	3.7	3.65	3.65	3.85
5	4.55	4.5	4.8	5.55	6.6	6.15	4.45	3.6	3.8	3.55	3.6	4.25
6	4.55	4.45	4.6	6.0	7.0	6.55	4.35	3.55	3.75	3.65	3.65	4.3
7	4.45	4.4	4.6	5.85	7.55	6.55	4.35	3.5	3.45	3.55	3.65	3.75
8	4.4	4.35	4.15	5.55	7.0	6.65	4.3	3.4	3.4	3.45	3.55	3.95
9	4.4	5.45	4.1	5.3	6.6	6.75	4.15	3.45	3.65	3.6	3.5	4.1
10	4.4	4.85	4.2	5.9	6.4	6.85	4.1	3.3	3.65	3.5	3.65	3.95
11	4.2	4.7	4.35	6.5	7.0	6.85	3.95	3.5	3.55	3.55	3.6	3.85
12	4.2	4.6	4.85	7.2	6.6	6.75	3.95	a3.5	3.75	3.55	3.65	3.9
13	4.25	4.3	5.0	7.35	6.45	6.45	4.05	3.55	3.7	3.45	3.6	3.9
14	5.65	4.35	5.4	7.6	6.5	6.35	4.0	3.55	3.55	3.55	3.55	3.65
15	5.0	4.15	5.45	7.45	6.6	6.4	3.9	3.45	3.65	3.95	3.55	4.05
16	4.65	4.25	5.8	6.95	6.4	6.2	3.8	3.5	3.75	4.85	3.55	3.85
17	4.6	4.2	5.85	6.65	6.15	5.9	3.75	3.45	3.6	3.95	3.55	3.65
18	4.6	4.3	5.8	6.7	6.8	5.5	3.65	3.45	3.8	3.75	3.6	3.55
19	4.3	4.2	5.8	7.5	7.05	5.55	3.7	3.35	3.8	3.55	3.5	3.45
20	4.5	4.2	5.75	8.2	6.6	5.4	3.75	8.5	3.8	3.8	3.5	3.45
21	5.0	4.2	5.85	8.2	6.5	5.8	3.75	3.3	3.65	3.7	3.6	3.55
22	5.55	4.1	5.7	7.2	6.7	5.7	3.7	3.5	3.7	3.7	3.5	3.55
23	5.15	4.2	5.6	6.8	7.15	5.4	3.65	3.65	3.75	3.65	3.55	3.75
24	5.35	4.05	5.8	6.45	7.2	5.5	3.6	3.35	3.8	3.6	3.95	3.65
25	5.3	4.05	5.9	6.35	7.25	5.3	3.5	3.35	a3.7	3.65	3.85	3.55
26	5.25	4.15	5.8	6.5	7.3	5.15	3.35	3.55	3.75	3.5	3.65	3.35
27	4.9	4.25	5.55	7.0	7.2	5.2	3.4	3.55	3.55	3.55	3.55	3.5
28	4.75	4.5	5.25	8.1	7.3	4.95	3.6	3.55	3.45	3.6	3.5	3.35
29	4.65	5.2	5.25	7.8	7.4	4.85	3.6	3.6	3.7	3.6	3.6	3.65
30	4.5	.....	5.25	8.35	7.2	4.8	3.4	3.6	3.7	3.45	3.55	3.5
31	4.5	.....	5.35	.....	6.95	.....	3.5	3.35	.....	3.55	.....	3.5

a Estimated.

Rating tables for Mokelumne River near Clements, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	150	5.50	885	7.00	1,885	10.00	4,340
4.10	185	5.60	945	7.20	2,025	11.00	5,310
4.20	220	5.70	1,005	7.40	2,170	12.00	6,310
4.30	260	5.80	1,065	7.60	2,320	13.00	7,310
4.40	305	5.90	1,130	7.80	2,470	14.00	8,310
4.50	350	6.00	1,195	8.00	2,620	15.00	9,310
4.60	400	6.10	1,260	8.20	2,780	16.00	10,310
4.70	450	6.20	1,325	8.40	2,940	17.00	11,310
4.80	500	6.30	1,395	8.60	3,100	18.00	12,310
4.90	550	6.40	1,465	8.80	3,260	19.00	13,310
5.00	605	6.50	1,535	9.00	3,440	20.00	14,310
5.10	660	6.60	1,605	9.20	3,620	21.00	15,310
5.20	715	6.70	1,675	9.40	3,800		
5.30	770	6.80	1,745	9.60	3,980		
5.40	825	6.90	1,815	9.80	4,160		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous high-water measurements, and is well defined between gage heights 4 feet and 9.5 feet. Above gage height 10.3 feet the rating curve is a tangent, the difference being 100 per tenth.

FOR 1908.

3.30	80	4.70	520	6.10	1,315	8.00	2,680
3.40	90	4.80	570	6.20	1,380	8.20	2,840
3.50	105	4.90	620	6.30	1,450	8.40	3,000
3.60	120	5.00	670	6.40	1,520	8.60	3,160
3.70	140	5.10	725	6.50	1,590	8.80	3,330
3.80	165	5.20	780	6.60	1,660	9.00	3,500
3.90	195	5.30	835	6.70	1,730	9.20	3,670
4.00	225	5.40	890	6.80	1,800	9.40	3,840
4.10	260	5.50	945	6.90	1,870	9.60	4,010
4.20	295	5.60	1,000	7.00	1,940	9.80	4,180
4.30	335	5.70	1,060	7.20	2,080	10.00	4,350
4.40	375	5.80	1,120	7.40	2,225		
4.50	420	5.90	1,185	7.60	2,375		
4.60	470	6.00	1,250	7.80	2,525		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1907 and 1908 and on previous high-water measurements, and is fairly well defined between gage heights 3.4 feet and 8 feet.

Monthly discharge of Mokelumne River near Clements, Cal., for 1907 and 1908.

[Drainage area, 642 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	4,020	525	1,140	1.78	2.05	70,100	B.
February	7,860	1,570	2,780	4.33	4.51	154,000	B.
March	15,300	1,500	4,880	7.60	8.76	300,000	C.
April	5,260	3,530	4,430	6.90	7.70	264,000	C.
May	5,810	2,740	4,220	6.57	7.57	259,000	B.
June	6,960	2,470	4,720	7.35	8.20	281,000	B.
July	5,310	1,710	3,330	5.19	5.98	205,000	B.
August	1,640	282	703	1.10	1.27	43,200	B.
September	400	185	257	.400	.45	15,300	C.
October	375	220	276	.430	.50	17,000	C.
November	282	135	234	.364	.41	13,900	C.
December	770	167	328	.511	.59	20,200	C.
The year	15,300	135	2,270	3.54	47.99	1,640,000	

Monthly discharge of Mokelumne River near Clements, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,030	295	537	0.836	0.96	33,000	B.
February	917	242	393	.612	.66	22,600	B.
March	1,180	260	817	1.27	1.46	50,200	B.
April	2,960	725	1,730	2.69	3.00	103,000	B.
May	2,680	1,350	1,900	2.96	3.41	117,000	B.
June	1,840	570	1,260	1.96	2.19	75,000	B.
July	570	85	229	.357	.41	14,100	B.
August	130	80	104	.162	.19	6,400	B.
September	165	97	135	.210	.23	8,030	B.
October	595	97	142	.221	.25	8,730	B.
November	210	105	124	.193	.22	7,380	B.
December	335	85	161	.251	.29	9,900	B.
The year	2,960	80	628	.977	13.27	455,000	

COSUMNES RIVER DRAINAGE BASIN.

DESCRIPTION.

The Cosumnes River basin lies on the western slope of the Sierra, north of the Mokelumne basin and south of the American basin. It does not reach the crest of the Sierra like these basins, but is wedged in between them. Its catchment area is somewhat elliptical in shape, or leaf-like, and has a length of about 55 miles and a width of 12 or 15 miles. Its total area above the valley rim is about 580 square miles.

Cosumnes River rises in the extreme eastern part of the basin at an altitude of 7,700 feet, and flows southwestward to its junction with the Mokelumne, about 6 miles east of Walnut Grove. Its total length is about 90 miles. The main stream is formed by the confluence of its three forks, about 45 miles above its mouth and 20 miles above the valley border.

This basin is characterized by many low hills and ridges separated by small irregular valleys. The upper part of the basin is more regular in aspect. The streams run in somewhat parallel and regular shallow canyons, which are separated by prominent ridges. The formation has a granitic base. Altitudes range from 200 feet in the foothills to 7,700 at the eastern border.

The forest cover in this basin consists of grass, brush, and scattering scrubby timber in the lower foothills. In the middle and upper parts of the basin there is a good timber growth. A small area of the upper basin is inclosed in a national forest.

The mean annual precipitation ranges from 20 inches in the valley to 35 or 40 inches at the higher elevations. The snowfall in this basin is comparatively light and soon disappears.

Very little irrigation, if any, is practiced in this area. Practically nothing is known concerning the opportunities for storage in this basin, but it is certain that some development is feasible.

The minimum flow of the stream is so small that but little power can be developed continually without storage.

The only gaging station in the basin is on Cosumnes River at Michigan Bar, 1907 to 1908.

COSUMNES RIVER AT MICHIGAN BAR, CAL.

This station, which is located at the Michigan Bar bridge, about 8 miles southwest of Latrobe, and not far from the Michigan Bar post-office, was established October 19, 1907, to obtain statistical information regarding the flow of Cosumnes River. The data are valuable in connection with the use of the river for irrigation and power development, and also in studying the flood problem of the Sacramento and San Joaquin valleys.

No tributaries enter below the station. Big Canyon Creek joins the main stream from the north about 6 miles above Michigan Bar, and the junction of the three forms is about 14 miles above.

Some water is diverted from the south side of the stream above the station and used for hydraulic mining near Michigan Bar. It is probable that all acquired water rights are for mining purposes.

The river bed is composed of sand and gravel and is subject to change. At low stages the current is very sluggish and at high stages very swift. The results are fairly satisfactory.

The monthly discharges for 1907 and 1908 include only the river at Michigan Bar bridge and take no account of the water diverted from the south side of the river above the station for hydraulic mining at Michigan Bar. No measurements have been made on the diversion ditch.

Discharge measurements of Cosumnes River at Michigan Bar, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	W. G. Steward	236	1,100	6.00	2,830
May 10	do	248	868	4.83	1,230
September 18	W. A. Lamb	72	228	3.13	41
October 9	do	40	26	3.18	58
1908.					
January 25	W. A. Lamb	250	738	4.55	886
February 15	do	236	535	3.90	229
April 10	do	223	547	3.90	294
September 18	W. V. Hardy			2.55	[a] 1
December 14	W. F. Martin	115	320	3.08	57.0

[a] Estimated.

Daily gage height, in feet, of Cosumnes River at Michigan Bar., Cal., for 1907 and 1908.

[C. B. Ruman, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1	.....	3.3	3.25	11	.....	3.2	4.15	21	3.2	3.3	3.6
2	.....	3.3	3.25	12	.....	3.25	3.8	22	3.2	3.3	3.6
3	.....	3.3	3.25	13	.....	3.25	3.7	23	3.2	3.7	3.6
4	.....	3.3	3.25	14	.....	3.25	3.7	24	3.2	3.3	3.5
5	.....	3.3	3.2	15	.....	3.25	3.6	25	3.3	3.3	3.45
6	.....	3.3	3.35	16	.....	3.2	3.6	26	3.4	3.3	3.5
7	.....	3.3	3.75	17	.....	3.2	3.6	27	3.4	3.25	4.15
8	.....	3.25	3.95	18	.....	3.2	3.5	28	3.45	3.25	4.05
9	.....	3.3	3.75	19	.....	3.2	3.4	29	3.4	3.25	3.95
10	.....	3.25	3.55	20	3.2	3.3	3.6	30	3.3	3.2	3.8
								31	3.3	.....	4.4

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.05	3.9	4.25	4.0	3.9	3.8	3.1	2.4	2.5	2.55	2.75	3.0
2	3.85	4.0	4.5	4.0	3.95	3.75	3.05	2.4	2.5	2.5	2.75	3.0
3	3.75	4.25	4.5	4.0	4.0	3.75	3.0	2.4	2.5	2.5	2.75	3.0
4	4.05	4.1	4.35	4.0	3.9	3.7	3.0	2.35	2.5	2.5	2.75	3.05
5	3.85	4.0	4.2	4.0	3.9	3.7	3.0	2.35	2.5	2.5	2.75	3.4
6	3.7	4.0	4.15	4.0	3.9	3.6	3.0	2.3	2.5	2.5	2.75	3.6
7	3.7	3.9	4.1	3.95	3.85	3.6	3.0	2.25	2.5	2.5	2.75	3.3
8	3.6	3.9	4.1	4.0	3.9	3.6	2.9	2.25	2.5	2.5	2.75	3.3
9	3.6	4.2	4.0	3.9	3.9	3.6	2.9	2.25	2.5	2.5	2.75	3.2
10	3.6	4.1	4.0	3.9	3.9	3.5	2.8	2.4	2.5	2.55	2.75	3.15
11	3.6	4.0	4.05	3.95	3.95	3.5	2.8	2.4	2.5	2.55	2.75	3.1
12	3.6	4.0	4.1	4.0	4.0	3.5	2.8	2.4	2.5	2.5	2.75	3.1
13	3.6	3.9	4.1	4.0	4.0	3.5	2.8	2.4	2.5	2.5	2.75	3.0
14	4.3	3.9	4.2	4.05	4.0	3.4	2.75	2.4	2.5	2.5	2.75	3.1
15	4.05	3.9	4.25	4.05	4.3	3.4	2.7	2.4	2.5	2.6	2.8	3.1
16	3.85	3.9	4.35	4.0	4.15	3.4	2.7	2.4	2.5	3.1	2.8	3.15
17	3.8	3.85	4.4	4.0	4.05	3.3	2.65	2.4	2.55	3.25	2.75	3.1
18	3.8	3.85	4.4	4.0	4.05	3.35	2.65	2.4	2.55	3.1	2.8	3.1
19	3.8	3.8	4.35	4.0	4.2	3.3	2.65	2.45	2.55	3.0	2.8	3.0
20	4.1	3.8	4.3	4.0	4.15	3.3	2.6	2.45	2.55	2.9	2.8	3.0
21	5.3	3.8	4.3	4.0	4.1	3.3	2.6	2.45	2.6	2.85	2.7	3.05
22	4.7	3.7	4.3	4.0	4.1	3.35	2.6	2.45	2.6	2.8	2.8	3.1
23	4.4	3.7	4.25	4.05	4.1	3.3	2.6	2.45	2.6	2.8	3.3	3.05
24	5.15	3.7	4.2	4.0	4.0	3.3	2.55	2.48	2.6	2.8	3.45	3.1
25	4.5	3.7	4.25	4.0	4.0	3.2	2.5	2.5	2.6	2.8	3.3	3.1
26	4.35	3.7	4.25	3.95	4.0	3.2	2.5	2.5	2.6	2.75	3.2	3.05
27	4.2	3.7	4.15	3.9	3.9	3.2	2.5	2.5	2.6	2.75	3.1	3.0
28	4.1	3.8	4.05	3.9	3.9	3.15	2.5	2.5	2.6	2.75	3.0	3.0
29	4.0	4.2	3.95	3.9	3.9	3.1	2.5	2.5	2.55	2.75	3.0	3.0
30	4.0	.....	4.0	3.9	3.85	3.1	2.45	2.5	2.55	2.75	3.0	3.0
31	3.9	.....	4.0	.....	3.85	.....	2.4	2.5	.....	2.75	.....	3.0

Rating table for Cosumnes River at Michigan Bar, Cal., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	0	3.30	72	4.10	450	4.90	1,410
2.60	5	3.40	90	4.20	545	5.00	1,590
2.70	12	3.50	114	4.30	640	5.10	1,780
2.80	19	3.60	142	4.40	740	5.20	1,980
2.90	27	3.70	180	4.50	850	5.30	2,180
3.00	36	3.80	225	4.60	970		
3.10	46	3.90	285	4.70	1,100		
3.20	58	4.00	360	4.80	1,245		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908, and is fairly well defined.

Monthly discharge of Cosumnes River at Michigan Bar, Cal., for 1907 and 1908.

[Drainage area, 524 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
October 20–31	.....	.....	73.2	0.140	0.06	1,740	B.
November	72	58	67.1	.128	.14	3,990	B.
December	497	58	195	.372	.43	12,000	B.
1908.							
January	2,180	142	471	.899	1.04	29,000	B.
February	592	180	306	.584	.63	17,600	B.
March	850	322	552	1.05	1.21	33,900	B.
April	405	285	346	.660	.74	20,600	B.
May	640	255	359	.685	.79	22,100	B.
June	225	46	106	.202	.23	6,310	B.
July	46	0	15.5	.030	.03	953	B.
August	0	0	0	.000	.00	0	B.
September	5	0	1.7	.003	.003	101	B.
October	65	0	13.5	.026	.03	830	B.
November	102	12	27	.052	.06	1,610	B.
December	142	36	48.8	.093	.11	3,000	B.
The year	2,180	0	187	.357	4.87	136,000	

NOTE.—These discharges include only the river at Michigan Bar bridge and do not include water diverted above the station for hydraulic mining. No measurements have been made of the diversion ditch.

NORTH PACIFIC OCEAN DRAINAGE.

KLAMATH RIVER DRAINAGE BASIN.

DESCRIPTION.

Klamath River drains a territory lying east of the Cascade Range in south-central Oregon and south of the Siskiyou Mountains in California. The river rises in upper Klamath Lake, flows generally southward, and reaches the Pacific Ocean at Requa, on the coast of northern California. Only that part of the basin lying in Oregon has been studied in detail. The drainage from this portion of the area is collected in large lakes whose margins are wide shallow marsh lands covered with tules and aquatic plants. From upper Klamath Lake, which stands 4,141 feet above sea level, flows Link River, a stream 1¼ miles long, discharging into Lake Ewauna at an elevation of 4,080 feet. Klamath Falls, the principal city of this section, is located on Link River. From Lake Ewauna to the town of Keno Klamath River flows through a flat marshy country a distance of 20 miles. About 5 miles above Keno the river is connected with lower Klamath Lake by a channel known as Klamath Straits. During high stages water flows from Klamath River into lower Klamath Lake, and during low water the direction of the flow is reversed. About half a mile below Keno the river breaks over a rocky ledge, and here begins its precipitous

fall of 100 to 200 feet per mile to its mouth. The drainage area above Keno, exclusive of lower Klamath Lake, is 3,150 square miles. The streams draining into upper Klamath Lake head about 6,000 feet above sea level. The elevation of Klamath Falls is 4,100 feet.

The principal tributaries of Klamath River are Sprague River, which drains the southwestern rim of the Great Basin divide in Oregon, and Anna River, which heads in a large spring supposed to be fed by the waters of Crater Lake. Williamson River, which drains the northern part of the Klamath Indian Reservation, is tributary to Sprague River. Lost River, although not a tributary of the Klamath, is usually considered with it, as a slough connects the two. Water formerly flowed in either direction, depending on which stream was higher, but the flow is now stopped by an artificial dike.

The mean annual rainfall at Klamath Falls, about 12 inches, is fairly representative for this section of the drainage area. A large part of this precipitation occurs as snow during the winter months. As nearly all the streams are spring fed and therefore rarely freeze, records of stream flow are little affected by ice.

Records of rainfall kept at three stations in this basin during 1907 and 1908 give results shown in the following table:

Precipitation at stations in drainage basin of Klamath River.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1907.													
Keno, Oreg.	.....	.....	.....	.....	.....	0.58	1.57	3.05	0.61	0.85	1.35	4.43	.....
Steele Swamp, Cal.[a]	0.90	3.80	4.88	[b]0.90	2.25	2.92	.20	1.71	.72	2.13	1.06	1.98	23.45
Horsefly, Oreg.[c]	.90	4.95	3.45	.70	1.75	2.25	[b].20	1.10	1.72	1.27	.72	.30	19.31
1908.													
Keno, Oreg.	.66	.86	1.29	.95	1.97	.79	.03	.15	.18	4.18	1.43	.99	13.48
Steele Swamp, Cal.	.38	.36	1.24	.59	1.92	.44	.15	.42	.....	2.00	1.00	1.10	9.60
Horsefly, Oreg.	[b].50	[b].15	[b].65	.....	.....	.....	.....	.....	.....	2.00	.....	.....	.....

[a] On headwaters of Lost River above Clear Lake.
[b] Estimated from known snowfall or by comparison with adjacent stations.
[c] At Garber's ranch near gaging station on Miller Creek, within area proposed for use as storage reservoir by United States Reclamation Service.

Irrigation is practiced extensively in the upper part of the area, although dry-farming methods have been fairly successful. The agricultural products consist chiefly of forage crops for stock and cattle, the country being well adapted to stock raising. Grains, alfalfa, and the hardier vegetables and fruits are grown with some degree of success, but the climate is too rigorous for the intensive agriculture possible at lower altitudes.

Within the period covered by stream-flow records the lowest run-off was in 1905 and the highest in 1907.

The following gaging stations have been maintained in this basin:

Sprague River at Yainax, Oreg. (1904).
Link River at Klamath Falls, Oreg. (1904–1908).
Klamath River at Keno, Oreg. (1904–1908).
Sycan River near Silverlake, Oreg. (1905).
Williamson River at Klamath Agency, Oreg. (1908).
Lost River at Clear Lake, Cal. (1904–8).
Lost River at Olene, Oreg. (1907–1908).
Lost River near Merrill, Oreg. (1904–1908).
Miller Creek at Horsefly, Oreg. (1904–1908).

Gage records have been obtained since 1904 on Upper Klamath Lake, Lower Klamath Lake, and Tule Lake, and during 1907 and 1908 three gages in Klamath River between upper and lower Klamath lakes were observed. Since 1905 records of evaporation have been kept at Keno.

UPPER KLAMATH LAKE NEAR KLAMATH FALLS, OREG.

Upper Klamath Lake is to be used by the United States Reclamation Service as a source of water supply to irrigate large areas of land. The main canal of the Klamath project (Pl. VI, *B*) has its intake at the lake.

A gage was installed on this lake near Klamath Falls, Oreg., May 28, 1904. The elevation of the zero of the gage is 4,136.13 feet. The daily records since February 16, 1906, are the mean daily heights obtained from a Frieze automatic water gage.

The winds have a marked effect on the level of the water surface of this lake. The water is lowered as much as 6 inches near the outlet when the wind blows from the south, and is raised as much over its normal level when the wind is in the opposite direction. Differences of a foot are frequently noticeable within a few hours. If the wind effect were eliminated the lake heights would show much more gradual changes than indicated by the accompanying records.

Daily gage height, in feet, of Upper Klamath Lake near Klamath Falls, Oreg., for 1907 and 1908.

[Ernest Jacobson and A. J. Santiman, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.15	5.35	6.20	7.05	6.92	6.60	5.85	5.20	4.80	4.85	4.90	4.98
2	5.15	5.50	6.30	7.00	6.90	6.60	5.80	5.25	4.80	4.80	4.90	4.98
3	5.15	5.55	6.70	6.90	7.00	6.58	5.85	5.20	4.80	4.77	5.00	5.20
4	5.15	5.65	6.60	6.60	6.95	6.50	5.85	5.15	4.80	4.75	5.00	5.40
5	5.20	5.90	6.45	6.80	6.85	6.55	5.88	5.15	4.80	4.75	5.02	5.00
6	5.40	6.05	6.35	6.85	6.80	6.60	5.70	5.12	4.82	4.75	5.02	5.10
7	5.40	6.20	6.35	7.05	6.85	6.55	5.75	5.10	4.85	4.75	5.00	5.00
8	5.40	6.30	6.35	7.08	6.85	6.40	5.75	5.15	4.85	4.85	5.00	5.05
9	5.40	6.40	6.40	7.03	6.70	6.30	5.70	5.15	4.85	4.75	4.95	5.05
10	5.40	6.50	6.30	7.05	6.70	6.25	5.68	5.05	4.85	4.55	4.80	5.00
11	5.40	6.50	6.40	7.08	6.78	6.20	5.68	5.10	4.87	4.55	4.80	5.10
12	5.40	6.50	6.45	7.09	6.90	6.25	5.70	5.05	4.90	4.60	4.90	5.00
13	5.40	6.55	6.35	7.09	6.80	6.28	5.60	5.05	4.90	4.68	4.95	5.30
14	5.40	6.55	6.30	7.15	6.78	6.30	5.60	5.05	4.85	4.66	4.90	5.40
15	5.40	6.55	6.30	7.15	6.75	6.30	5.55	5.05	.....	4.68	4.90	5.35

Daily gage height, in feet, of Upper Klamath Lake near Klamath Falls, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	5.40	6.55	6.30	7.10	6.75	6.25	5.55	5.05	.....	4.68	4.95	5.35
17	5.40	6.50	5.70	7.13	6.72	6.25	5.55	4.85	.....	4.67	4.90	5.35
18	5.40	6.55	6.25	7.10	6.48	6.25	5.55	4.85	.....	4.66	5.10	5.35
19	5.40	6.55	6.05	7.08	6.63	6.20	5.55	4.85	.....	4.70	5.10	5.30
20	5.40	6.55	5.95	7.07	6.63	6.20	5.45	4.85	.....	4.72	5.15	5.30
21	5.40	6.50	6.35	7.10	6.65	6.25	5.38	4.85	4.72	4.72	5.10	5.30
22	5.40	6.55	6.00	7.15	6.68	6.20	5.35	4.85	4.72	4.70	5.00	5.25
23	5.40	6.45	6.25	7.20	6.62	6.11	5.35	4.85	4.70	4.70	5.00	5.25
24	5.40	6.15	6.80	7.20	6.65	6.10	5.32	4.95	4.68	4.75	4.90	5.25
25	5.40	6.10	6.90	7.15	6.60	6.08	5.37	4.98	4.70	4.70	4.90	5.20
26	5.40	6.25	7.00	7.15	6.65	6.05	5.38	5.00	4.70	4.75	4.80	5.65
27	5.40	6.40	7.05	7.20	6.65	5.98	5.30	4.95	4.80	4.90	4.90	5.60
28	5.40	6.25	7.00	6.95	6.65	6.00	5.27	4.95	4.95	4.95	4.95	5.70
29	5.35	.....	6.90	7.00	6.60	5.95	5.25	4.95	4.85	4.90	4.98	5.70
30	5.35	.....	6.95	6.95	6.58	5.85	5.23	4.95	4.80	4.90	5.00	5.50
31	5.35	.....	.....	.....	6.60	.....	5.20	4.85	.....	4.92	.....	5.60
1908.												
1	5.60	5.70	5.40	5.70	5.35	.....	4.85	4.47	4.25	4.80	4.70	4.92
2	5.60	.....	5.45	5.65	5.58	.....	4.80	4.42	4.25	4.90	4.70	4.88
3	5.60	.....	5.45	5.85	5.60	.....	4.75	4.18	4.25	4.61	4.75	4.85
4	5.70	.....	5.50	5.70	5.48	.....	4.75	4.20	4.25	4.50	4.75	4.90
5	5.70	5.65	5.55	5.75	5.45	.....	.....	4.18	4.34	4.45	4.75	4.90
6	5.75	5.65	5.55	5.90	5.20	5.24	4.72	4.15	4.30	4.50	4.75	4.85
7	5.75	5.65	5.50	5.85	5.60	5.05	4.67	4.13	4.45	4.50	4.75	5.00
8	5.60	5.60	5.47	5.70	5.60	5.15	4.70	4.26	4.34	4.45	.....	5.05
9	5.75	5.60	5.47	5.60	5.55	5.05	.....	4.35	4.35	4.50	.....	4.95
10	5.75	5.60	5.45	5.55	5.35	5.05	4.65	4.38	4.36	4.50	.....	5.10
11	5.75	5.60	5.46	5.55	5.60	5.10	4.61	4.35	4.34	4.50	4.75	5.05
12	5.85	5.60	5.45	5.53	5.50	5.05	4.60	4.42	4.37	4.45	4.75	5.05
13	5.83	5.58	5.45	5.55	5.30	5.08	4.50	4.40	4.40	4.35	4.75	4.90
14	5.88	5.57	5.45	5.50	5.35	5.15	4.55	4.38	4.40	4.50	4.74	4.95
15	5.85	5.55	5.40	5.50	5.35	5.10	4.60	4.28	4.55	4.70	4.72	4.90
16	5.82	5.55	5.45	5.40	5.32	5.10	4.40	4.28	4.55	4.74	4.68	4.97
17	5.80	5.55	5.50	5.35	4.95	5.10	4.60	4.28	4.40	4.80	4.60	4.96
18	5.60	5.53	5.38	5.40	5.25	5.05	4.60	4.28	4.40	.....	4.72	4.95
19	5.60	5.54	5.40	5.50	5.40	4.95	4.55	4.28	4.45	5.01	4.40	4.95
20	5.80	5.55	5.50	5.70	5.35	4.80	4.55	4.29	4.45	5.00	4.70	4.98
21	5.82	5.53	5.40	5.60	5.40	4.95	4.58	4.30	4.45	4.75	4.65	4.98
22	5.80	5.55	5.50	5.50	5.40	4.85	4.60	4.30	4.50	4.75	.....	5.00
23	5.75	5.52	5.45	5.35	5.32	4.80	4.40	4.40	4.70	4.74	4.90	4.98
24	5.78	5.49	5.40	5.60	5.45	4.80	4.50	4.60	4.65	4.74	4.83	4.98
25	5.85	5.47	.....	5.48	5.50	4.80	4.40	4.32	4.50	4.75	4.85	4.95
26	5.90	5.45	.....	5.52	5.40	4.90	.....	4.35	4.50	4.73	4.90	4.95
27	5.80	5.50	.....	5.65	5.40	4.80	4.70	4.50	.....	4.72	4.85	4.95
28	5.75	5.35	.....	5.58	5.40	4.85	4.54	4.60	4.45	4.65	4.85	4.95
29	5.75	5.10	.....	5.50	5.55	4.90	4.55	4.60	4.45	4.55	4.85	4.95
30	5.85	.....	5.75	5.40	5.50	4.85	4.48	4.25	4.45	4.68	4.85	4.95
31	5.75	.....	5.75	.....	.....	.....	4.45	4.25	.....	4.72	.....	4.95

NOTE.—The breaks in the record were caused by the stopping of the automatic register, or the loss of record sheets.

LINK RIVER AT KLAMATH FALLS, OREG.

This station, which was established May 15, 1904, is located at the county bridge over Link River at Klamath Falls, 1¼ miles below the outlet of Upper Klamath Lake and immediately at the head of Lake Ewauna. The river has a fall of 70 feet in the 1¼ miles between the lakes, a portion of which is utilized for water power.

The records prior to June 6, 1908, especially the individual daily records, are not reliable. It is probable that for longer periods—a

month or more—the total flow can be accepted as not greatly in error. This condition is accounted for by the effect of winds on the flow of water at this station. The gage until May 8, 1908, was located at the bridge at the upper end of Lake Ewauna. At the outlet of Upper Klamath Lake the river breaks over a rather shallow ledge. A strong wind upstream blows the water back from this outlet and at the same time increases the height of water on the gage by backing the water in Lake Ewauna. Thus we have diminished flow with increased gage height. So great is this wind effect that the river has been known to go entirely dry for a few hours at a time. When the wind is downstream the flow of Link River is greatly increased; but owing to the large surface of Lake Ewauna this increase in flow is not shown by the gage heights. In the long run these wind effects are no doubt compensatory, but little dependence can be placed in the published daily records prior to March 7, 1907. On the later date an anemometer was installed on the bridge and a ship's taffrail log was trailed in the water under the bridge. It was hoped that the daily reading from this log would afford some indication of the velocities with the anemometer records. Although the records obtained by this device were much more reliable during 1907 than previously, even they were not all that could be desired. It became evident that owing to the sudden changes of the wind complete data could not be obtained without automatic recording devices on both the log and anemometer. The method was effective, however, in reducing the probable error of the estimates from about 15 per cent to within less than 5 per cent. On June 6, 1908, a Friez gage was installed in the rapids where it could be affected only by change in flow, measurements being made at the bridge as formerly, and since that date the records are reliable. The data presented are made up in the following manner:

For January 1 to March 7, 1907, the old rating curve was used with the gage heights observed at the bridge. March 7, 1907, to June 6, 1908, the records of the anemometer and the taffrail log were used in determining the daily discharge. For the period following June 6, 1908, the permanent rating curve has been developed for the gage at the foot of the rapids, and discharges have been estimated in the usual manner, using the mean daily gage height taken from the register sheet.

Discharge measurements of Link River at Klamath Falls, Oreg., in 1907 and 1908.

GAGE AT BRIDGE.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 10	L. F. Hendricks	280	1,420	3.80	2,300
February 18	do	298	1,780	4.90	4,910
March 2	do	292	1,810	5.00	4,980
April 1	do	294	1,990	5.60	5,620
April 20	do	295	2,050	5.80	5,570
May 9	Stevens and Ellsworth	294	2,040	5.65	4,000
May 23	J. C. Stevens	298	1,950	5.30	4,220
June 13	C. E. Ellsworth	290	1,830	4.98	4,390
June 19	do	292	1,780	4.85	3,740
July 5	do	297	1,630	4.35	2,450
July 23	do	281	1,490	3.85	1,950
July 31	do	277	1,430	3.65	1,640
August 12	do	273	1,340	3.40	1,610
September 4	do	271	1,290	3.15	1,640
September 19	do	271	1,280	3.05	1,490
October 26	do	273	1,340	3.25	1,870
November 13	do	280	1,360	3.32	1,830
1908.					
February 17	C. E. Ellsworth	286	1,650	4.19	3,030
March 14	do	286	1,650	4.20	2,800
March 21	do	286	1,640	4.15	2,890
April 3	do	288	1,640	4.36	3,800
April 15	do	287	1,610	4.26	2,620
April 18	do	286	1,610	4.18	2,700
April 21	do	287	1,640	4.28	2,610
April 25	Ellsworth and Kimble	286	1,580	4.16	2,820
April 30	do	286	1,580	4.16	2,670
May 5	do	284	1,580	4.11	2,560
May 9	H. Kimble	283	1,550	4.02	2,620
May 13	do	284	1,570	4.07	2,680
May 18	do	282	1,550	4.03	2,170
May 21	do	283	1,550	4.04	2,980
May 25	do	282	1,520	3.94	2,530
May 30	do	276	1,520	3.87	2,910
June 4	do	277	1,490	3.76	2,290
June 13	do	277	1,470	.....	2,000

FRIEZ GAGE.

1908.					
June 17	H. Kimble	277	1,430	1.85	2,110
June 23	do	276	1,410	.....	1,710
June 29	do	275	1,380	1.65	1,760
July 1	do	275	1,360	1.57	1,620
July 7	do	272	1,330	1.42	1,570
July 9	do	271	1,330	1.44	1,530
July 13	do	271	1,300	1.70	1,920
July 18	do	269	1,270	1.33	1,330
July 22	do	268	1,280	1.30	1,390
July 28	do	267	1,220	1.19	1,210
August 14	do	265	1,160	1.20	1,250
September 1	do	264	1,130	.75	715
September 16	do	264	1,100	1.02	1,080
September 29	do	266	1,130	.92	936
October 13	do	268	1,190	1.20	1,180
October 26	do	272	1,340	1.59	1,760
October 31	do	272	1,310	1.60	1,720
November 13	do	274	1,340	1.65	1,870
December 7	do	276	1,370	1.64	1,830

Daily gage height, in feet, of Link River at Klamath Falls, Oreg., for 1907 and 1908.

[Ernest Jacobson, observer.]

GAGE AT BRIDGE.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.60	3.90	5.02	5.60	5.68	5.28	4.42	3.55	3.15	3.12	3.28	3.43
2	3.85	3.95	5.00	5.68	5.70	5.25	4.45	3.52	3.15	3.10	3.30	3.45
3	3.80	4.10	5.05	5.62	5.65	5.15	4.40	3.50	3.15	3.15	3.30	3.48
4	3.80	4.25	5.10	5.75	5.60	5.12	4.38	3.48	3.15	3.15	3.29	3.50
5	3.75	4.25	5.12	5.65	5.65	5.08	4.32	3.45	3.15	3.10	3.28	3.40
6	3.75	4.32	5.15	5.70	5.62	5.05	4.32	3.42	3.15	3.15	3.30	3.50
7	3.75	4.40	5.12	.....	5.68	5.00	4.28	3.38	3.10	3.15	3.30	3.46
8	3.75	4.45	5.10	5.72	5.62	4.95	4.25	3.35	3.10	3.10	3.33	.....
9	3.80	4.50	5.10	5.70	5.62	4.92	4.20	3.35	.....	3.10	3.30	3.45
10	3.80	4.55	5.10	5.72	5.70	4.90	4.18	3.30	.....	3.10	3.35	3.52
11	3.80	4.62	5.15	5.75	5.62	4.98	4.18	3.30	.....	3.15	3.35	3.49
12	3.80	4.70	5.15	5.79	.....	4.95	4.15	3.32	.....	3.12	3.36	3.58
13	3.80	4.75	5.05	5.80	5.48	4.90	4.12	3.28	.....	3.12	3.32	3.62
14	3.80	4.80	5.05	5.78	5.50	4.88	4.02	3.25	.....	3.18	3.30	3.55
15	3.82	4.80	5.10	5.75	5.50	4.82	3.98	3.25	.....	3.15	3.36	.....
16	3.82	4.80	5.05	5.75	5.48	4.82	3.95	3.25	.....	3.15	3.32	.....
17	3.85	4.85	5.10	5.75	5.42	4.82	3.90	3.22	3.10	3.15	3.35	3.60
18	3.85	4.90	5.20	5.80	5.45	4.85	3.88	3.20	3.08	3.15	3.32	3.60
19	3.85	4.90	5.32	5.78	5.40	4.82	3.88	3.20	3.10	3.16	3.36	3.67
20	3.85	4.90	5.28	5.75	5.32	4.78	3.88	3.18	3.12	.....	3.36	3.65
21	3.90	4.90	5.45	5.80	5.38	4.75	3.82	3.15	3.10	.....	3.39	3.60
22	3.90	4.90	5.62	5.80	5.35	4.70	3.80	3.15	3.10	.....	3.39	.....
23	3.88	4.90	5.35	5.78	5.35	4.70	3.80	3.15	3.15	3.20	3.38	3.69
24	3.82	5.00	5.42	5.78	5.32	4.65	3.78	3.30	3.12	3.21	.....	.....
25	3.80	5.05	5.48	5.75	5.30	6.62	3.75	3.22	3.18	3.25	3.40	3.70
26	3.80	5.00	5.48	5.70	5.28	4.65	3.75	3.20	3.08	3.25	3.41	3.95
27	3.80	5.00	5.52	5.72	5.30	4.60	3.70	3.18	3.12	3.30	3.40	3.90
28	3.80	4.92	5.58	5.68	5.30	4.55	3.70	3.20	3.10	3.30	3.40	3.92
29	3.80	.....	5.62	5.65	5.28	4.52	3.65	3.18	3.10	3.30	.....	3.97
30	3.82	.....	5.58	5.62	5.25	4.52	3.65	3.15	3.15	3.30	3.42	4.02
31	3.90	.....	5.60	.....	5.28	.....	3.60	3.15	.....	3.25	.....	4.00
1908.												
1	4.00	4.40	.....	4.22	4.25	3.84	3.37	2.90	2.50	2.58	3.19	3.37
2	4.01	4.50	4.22	4.25	4.14	3.76	3.38	.....	2.52	.....	3.26	3.38
3	4.05	4.40	4.20	4.35	.....	3.77	3.38	2.79	2.60	2.51	3.20	3.40
4	.....	4.34	4.20	4.24	4.09	3.75	.....	2.82	2.60	2.59	3.17	3.44
5	4.00	4.34	4.22	.....	4.11	3.75	3.25	2.78	2.47	2.55	3.20	3.43
6	4.04	4.50	4.20	4.24	4.22	3.74	3.25	2.80	.....	2.58	3.18	3.43
7	4.10	4.31	4.21	4.27	4.12	3.80	3.25	2.77	2.45	2.58	.....	3.42
8	4.18	4.50	.....	4.21	4.06	.....	3.23	2.72	2.39	2.72	.....	3.53
9	4.12	.....	4.20	4.24	4.04	3.74	3.20	.....	2.43	2.68	.....	3.44
10	4.08	4.24	.....	4.25	4.06	3.72	3.18	2.77	2.46	2.75	3.24	3.42
11	4.10	4.25	4.20	4.26	4.05	3.68	3.11	2.70	2.46	.....	.....	3.40
12	.....	4.24	4.20	.....	4.06	3.71	3.17	2.72	2.44	.....	3.23	3.34
13	4.11	4.26	4.18	4.35	4.04	3.74	3.15	2.62	2.43	2.75	3.25	3.47
14	4.12	4.25	4.20	4.27	4.01	3.65	3.12	.....	2.43	.....	3.25	3.41
15	4.14	.....	4.20	4.22	4.04	3.68	3.06	2.68	2.46	.....	3.27	3.40
16	4.10	4.30	4.19	4.28	4.05	3.66	3.08	.....	2.43	3.01	3.25	3.4
17	4.15	4.22	4.22	4.30	4.10	3.60	3.07	2.70	2.44	.....	.....	3.48
18	4.20	4.24	4.14	4.20	4.03	3.66	3.05	.....	2.47	.....	3.28	3.48
19	.....	4.20	4.19	4.18	3.98	3.56	3.05	2.68	2.48	3.16	3.50	3.50
20	4.20	4.22	4.22	4.29	4.01	3.85	.....	2.63	.....	3.20	3.34	3.50
21	4.20	4.20	4.15	4.24	4.02	3.47	3.02	.....	.....	.....	3.30	.....
22	4.20	4.20	4.20	4.18	3.96	3.52	2.98	2.67	2.45	3.11	3.30	3.48
23	4.25	.....	4.18	4.18	3.95	3.53	2.99	.....	2.45	3.11	3.32	.....
24	4.22	4.22	4.40	4.22	4.03	3.50	2.99	2.62	2.46	3.14	3.35	3.48
25	4.22	4.25	4.18	4.16	3.96	3.47	2.91	2.53	.....	3.23	3.35	3.50
26	.....	4.30	4.25	4.16	3.88	3.40	.....	2.56	2.48	.....	3.34	3.48
27	4.25	4.20	.....	4.15	3.85	3.40	2.95	2.57	2.53	.....	3.35	.....
28	4.22	4.25	4.15	4.17	3.96	3.40	.....	2.54	2.53	3.33	3.36	.....
29	4.21	.....	4.25	4.16	3.85	3.41	.....	2.48	2.53	3.30	.....	3.46
30	.....	.....	4.22	4.21	3.80	3.41	2.88	.....	2.51	3.16	3.25	.....
31	4.19	.....	4.20	.....	3.83	.....	2.90	2.49	.....	3.18	.....	3.50

Daily gage height, in feet, of Link River at Klamath Falls, Oreg., for 1907 and 1908—Continued.

GAGE AT FOOT OF RAPIDS.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1908.					1908.				
1		2.82	2.00	2.48	16	2.75	2.65	2.55	
2		2.80	2.70		17	2.81	2.53	2.25	
3		3.20		2.60	18	2.65	2.65	2.60	
4		2.80	2.65	2.40	19	2.70	2.70	2.50	
5			2.60	2.40	20	2.80	2.74	2.54	
6			2.30	2.22	21	2.70	2.60	2.58	
7			2.55	2.25	22	2.70	2.62		
8		2.80	2.63		23	2.63		2.55	
9	2.65	2.72	2.68		24		2.90	2.60	
10			2.60		25	2.85	2.75	2.66	
11	2.65	2.74	2.75		26	2.85	2.74	2.54	
12	2.68		2.70		27		2.84	2.46	
13	2.60		2.54		28	2.83		2.60	
14	2.66	2.66	2.40		29		2.65	2.75	
15		2.60			30	2.92		2.68	
					31	2.90		2.45	

FRIEZ AUTOMATIC GAGE.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.								1908.							
1		1.63	1.21	0.80	1.20		1.90	16	1.90	1.38	1.00	1.00	0.62		1.55
2		1.64	1.22	.77	1.30	1.55	1.95	17	1.86	1.40	1.01	.90	.70		1.70
3		1.58	1.16	.76	1.05	1.62	1.95	18	1.90	1.37	1.00	.90			1.70
4		1.62	1.16	.74	1.00	1.60	1.90	19	1.82	1.35	1.02	.95	1.95		1.70
5		1.58	1.15	.80	.96	1.62	1.79	20	1.52	1.30	1.02	.97	1.92		1.70
6	1.84	1.54	1.13	.80	.98	1.64	1.68	21	1.72	1.36	1.02	.96	1.52	1.60	1.72
7	1.84	1.46	1.10	.91	.96	1.64	1.70	22	1.68	1.30	1.03	.98	1.58	1.65	1.73
8	1.84	1.46	1.08	.86	.94		1.75	23		1.30	1.02	1.16	1.59	1.65	1.74
9	1.82	1.46	1.10	.86	1.00		1.65	24		1.30	1.10	1.10	1.60	1.65	1.73
10	1.80	1.46	1.08	.86	1.16		1.60	25		1.34	.90	1.00	1.62	1.60	1.72
11	1.80	1.42	1.06	.83	1.35		1.65	26		1.30	.87	.94	1.62	1.52	
12	1.78	1.40	1.13	.87	1.30		1.75	27	1.78	1.26	.87	.93	1.60	1.54	
13	1.77	1.36	1.16	.90	1.20			28	1.68	1.22	.85	.94	1.54	1.58	
14	1.80	1.42	1.08	.89	.80		1.70	29	1.65	1.25	.98	.94	1.35	1.65	
15	1.86	1.50	1.02	.94	.58		1.70	30	1.66	1.17	.80	.96	1.56	1.62	1.70
								31		1.14	.80		1.56		1.69

Rating tables for Link River at Klamath Falls, Oreg.

GAGE AT BRIDGE, MAY 15, 1904, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	935	3.50	1,800	4.60	3,400	5.70	5,570
2.50	985	3.60	1,920	4.70	3,580	5.80	5,790
2.60	1,035	3.70	2,045	4.80	3,770	5.90	6,020
2.70	1,090	3.80	2,175	4.90	3,960	6.00	6,250
2.80	1,150	3.90	2,310	5.00	4,150	6.20	6,710
2.90	1,220	4.00	2,450	5.10	4,340	6.40	7,180
3.00	1,300	4.10	2,590	5.20	4,530	6.60	7,660
3.10	1,390	4.20	2,740	5.30	4,730	6.80	8,140
3.20	1,485	4.30	2,900	5.40	4,930		
3.30	1,585	4.40	3,060	5.50	5,140		
3.40	1,690	4.50	3,230	5.60	5,350		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1908 and is not well defined.

Rating tables for Link River at Klamath Falls, Oreg.—Continued.

FRIEZ AUTOMATIC GAGE, JUNE 6 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	625	1.00	994	1.40	1,474	1.80	2,036
.70	703	1.10	1,106	1.50	1,612	1.90	2,184
.80	792	1.20	1,224	1.60	1,750	2.00	2,332
.90	888	1.30	1,344	1.70	1,892		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on eighteen discharge measurements made during 1908 and is well defined.

Daily discharge, in second-feet, of Link River at Klamath Falls, Oreg., for 1908.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1		3,290	2,690	2,510	16	2,610	2,670	2,430	
2		3,170	2,670	2,530	17	2,590	2,560	2,380	
3		3,230	2,670	2,420	18	2,780	2,650	2,300	
4		3,450	2,720	2,260	19	2,670	2,860	2,520	
5		3,230	2,730	2,130	20	2,650	2,710	2,490	
6		3,410	2,620		21	2,760	2,690	2,750	
7	2,600	3,540	2,610		22	2,650	2,700	2,640	
8	2,610	3,250	2,970		23	2,650	2,640	2,580	
9	2,620	3,050	2,770		24	2,570	2,960	2,880	
10	2,530	2,870	2,600		25	2,700	3,000	2,900	
11	2,580	3,020	2,600		26	3,020	2,970	2,570	
12	2,630	3,050	2,750		27	3,100	3,180	2,550	
13	2,380	2,960	2,540		28	3,120	3,180	2,470	
14	2,530	3,020	2,230		29	2,970	3,000	2,620	
15	2,440	2,770	2,380		30	3,070	2,670	2,790	
					31	3,180		2,660	

NOTE.—These discharges were obtained from the gage heights at the bridge, taking into account also the readings of the taffrail log and the direction and force of the wind.

Monthly discharge of Link River at Klamath Falls, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	2,310	1,920	2,190	135,000	C.
February	4,240	2,310	3,530	196,000	C.
March	5,390	4,150	4,650	286,000	C.
April	5,790	5,350	5,630	335,000	C.
May	5,570	4,630	5,090	313,000	C.
June	7,710	3,260	4,020	239,000	C.
July	3,140	1,920	2,470	152,000	C.
August	1,860	1,440	1,570	96,500	C.
September	1,470	1,370	1,410	83,900	C.
October	1,580	1,390	1,460	89,800	C.
November	1,710	1,560	1,630	97,000	C.
December	2,480	1,690	1,970	121,000	C.
The year	7,710	1,370	2,970	2,140,000	
1908.					
January	2,820	2,450	2,660	164,000	C.
February	3,230	2,740	2,890	166,000	C.
March	3,180	2,380	2,730	168,000	B.
April	3,540	2,560	2,990	178,000	B.
May	2,970	2,230	2,620	161,000	B.
June	2,530	1,640	2,060	123,000	A.
July	1,810	1,150	1,470	90,400	A.
August	1,250	792	1,040	64,000	A.
September	1,180	739	900	53,600	A.
October	2,260	612	1,350	83,000	A.
November	1,820	1,640	1,770	105,000	A.
December	2,260	1,680	1,940	119,000	A.
The year	3,540	612	2,040	1,480,000	

NOTE.—Discharges for January 1, 1907, to March 6, 1908, are based on the gage heights at the bridge. From March 7 to June 5, 1908, the taffrail log readings are also taken into consideration. For June 6 to December 31 they are based on the Friez gage records.

Monthly discharge of Link River at Klamath Falls, Oreg., for 1907 and 1908—Continued.

GAGE AT BRIDGE.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
March	3,060	2,650	2,750	169,000	
April	2,980	2,660	2,790	166,000	
May	2,820	2,180	2,480	152,000	
June	2,240	1,690	1,970	117,000	
July	1,670	1,210	1,400	86,100	
August	1,220	975	1,080	66,400	
September	1,040	931	973	57,900	
October	1,620	990	1,280	78,700	
November	1,800	1,460	1,560	92,800	
December	1,840	1,630	1,750	108,000	

NOTE.—These discharges are based on gage readings at the bridge and are included only for comparative purposes. The records at the Friez gage are more reliable.

LOWER KLAMATH LAKE NEAR BROWNELL, CAL.

Lower Klamath Lake is connected with Klamath River by the Klamath Straits. The Southern Pacific Company has constructed a railroad through the marshes parallel to Klamath River. The embankment which crosses Klamath Straits is provided with gates whereby the surface flow can be regulated.

A gage was established in Lower Klamath Lake near Brownell, Cal., January 23, 1907. The elevation of the zero of the gage is 4,082.50 feet, and all gage heights have been referred to this datum. The normal area of the lake is 21,000 acres.

Daily gage height, in feet, of Lower Klamath Lake near Brownell, Cal., for 1907 and 1908.

[J. T. Jensen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	3.0	3.9	4.3	4.7	4.3	3.8	2.8	2.4	2.3	2.1	2.6
2	.....	3.0	3.9	4.4	4.7	4.3	3.8	2.7	2.4	2.3	2.1	2.6
3	.....	3.1	3.9	4.4	4.8	4.3	3.7	2.7	2.4	2.3	2.1	2.6
4	.....	3.2	3.9	4.4	4.8	4.3	3.7	2.6	2.4	2.3	2.2	2.6
5	.....	3.2	3.9	4.4	4.7	4.3	3.6	2.6	2.4	2.3	2.3	2.6
6	.....	3.2	3.9	4.5	4.6	4.3	3.6	2.6	2.4	2.3	2.3	2.6
7	.....	3.3	4.0	4.5	4.7	4.2	3.5	2.6	2.4	2.3	2.4	2.6
8	.....	3.3	4.0	4.5	4.6	4.2	3.5	2.6	2.4	2.3	2.4	2.6
9	.....	3.3	4.0	4.4	4.5	4.2	3.5	2.6	2.4	2.3	2.4	2.6
10	.....	3.3	4.0	4.4	4.5	4.2	3.4	2.6	2.4	2.3	2.4	2.6
11	.....	3.3	4.0	4.4	4.6	4.2	3.4	2.6	2.3	2.3	2.4	2.6
12	.....	3.4	4.0	4.4	4.6	4.2	3.4	2.6	2.3	2.3	2.4	2.6
13	.....	3.4	4.0	4.4	4.5	4.2	3.4	2.6	2.3	2.3	2.4	2.6
14	.....	3.4	4.0	4.5	4.5	4.2	3.4	2.6	2.3	2.3	2.5	2.6
15	.....	3.4	4.1	4.6	4.4	4.1	3.4	2.6	2.3	2.3	2.5	2.6
16	.....	3.4	4.1	4.6	4.5	4.1	3.4	2.6	2.3	2.3	2.5	2.6
17	.....	3.5	4.1	4.6	4.5	4.1	3.4	2.6	2.3	2.3	2.5	2.6
18	.....	3.5	4.1	4.7	4.3	4.1	3.3	2.6	2.3	2.3	2.5	2.6
19	.....	3.6	4.1	4.7	4.4	4.1	3.3	2.5	2.3	2.3	2.5	2.7
20	.....	3.7	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
21	.....	3.7	4.1	4.7	4.3	4.1	3.2	2.5	2.3	2.3	2.5	2.7
22	.....	3.7	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
23	2.9	3.8	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
24	2.9	3.7	4.1	4.7	4.4	4.1	3.1	2.5	2.3	2.3	2.5	2.7
25	2.9	3.8	4.1	4.7	4.4	4.0	3.1	2.5	2.3	2.3	2.5	2.7

Daily gage height, in feet, of Lower Klamath Lake near Brownell, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	2.9	3.8	4.2	4.7	4.4	4.0	3.0	2.5	2.3	2.3	2.5	2.7
27	2.9	3.8	4.3	4.7	4.4	3.9	3.0	2.5	2.3	2.3	2.5	2.7
28	2.9	3.8	4.3	4.7	4.4	3.8	3.0	2.5	2.3	2.2	2.5	2.7
29	2.9	.....	4.3	4.7	4.4	3.8	3.0	2.5	2.3	2.2	2.5	2.7
30	2.9	.....	4.3	4.7	4.3	3.8	2.9	2.5	2.3	2.2	2.6	2.7
31	3.0	.....	4.3	.....	4.3	.....	2.9	.....	.....	2.2	.....	2.7
1908.												
1	2.8	3.2	3.3	3.3	3.2	3.1	.....	2.1	1.7	1.6	2.1	2.4
2	2.8	3.2	3.3	3.3	3.2	3.1	.....	2.1	1.7	1.6	2.1	2.4
3	2.8	3.2	3.3	3.3	3.2	3.1	2.5	2.1	1.7	1.6	2.1	2.4
4	2.8	3.3	3.3	3.3	3.2	3.1	2.5	2.1	1.7	1.7	2.2	2.4
5	2.8	3.3	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.4
6	2.8	3.3	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.3
7	2.8	3.4	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.2
8	2.8	3.4	3.4	3.3	3.2	3.0	2.5	1.9	1.7	1.7	2.2	2.2
9	2.8	3.4	3.4	3.3	3.2	3.0	2.5	1.9	1.7	1.7	2.2	2.2
10	2.8	3.4	3.4	3.3	3.2	3.0	2.4	1.9	1.6	1.7	2.2	2.2
11	2.8	3.4	3.4	3.3	3.2	3.0	2.4	1.9	1.6	1.8	2.2	2.3
12	2.9	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.8	2.3	2.3
13	2.9	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.9	2.3	2.4
14	3.0	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.9	2.3	2.5
15	3.0	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	2.0	2.3	2.5
16	3.0	3.4	3.4	3.2	3.1	2.9	2.3	1.9	1.6	2.0	2.3	2.5
17	3.0	3.4	3.4	3.0	3.1	2.9	2.3	1.9	1.6	2.0	2.3	2.5
18	3.1	3.4	3.4	3.1	3.1	2.9	2.3	1.9	1.6	2.1	2.3	2.5
19	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.9	1.6	2.1	2.2	2.5
20	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.9	1.6	2.1	2.2	2.5
21	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.8	1.6	2.1	2.2	2.5
22	3.1	3.4	3.3	3.0	3.1	2.8	2.2	1.8	1.6	2.1	2.2	2.5
23	3.1	3.4	3.3	3.0	3.1	.....	2.2	1.8	1.7	2.1	2.2	2.5
24	3.1	3.4	3.3	3.1	3.1	.....	2.2	1.8	1.7	2.1	2.2	2.5
25	3.1	3.4	3.3	3.2	3.1	.....	2.1	1.8	1.7	2.1	2.3	2.5
26	3.1	3.4	3.3	3.2	3.1	.....	2.1	1.8	1.7	2.1	2.4	2.5
27	3.1	3.4	3.3	3.2	3.1	.....	2.1	1.8	1.7	2.1	2.4	2.5
28	3.1	3.3	3.3	3.2	3.1	.....	2.1	1.8	1.7	2.1	2.4	2.5
29	3.2	3.3	3.3	3.2	3.1	.....	2.1	1.8	1.6	2.1	2.4	2.5
30	3.2	.....	3.3	3.2	3.1	.....	2.1	1.7	1.6	2.1	2.4	2.5
31	3.2	.....	3.3	.....	3.1	.....	2.1	1.7	.....	2.1	.....	2.5

KLAMATH RIVER GAGES.

The lands along the course of Klamath River through the bordering marshes from Klamath Falls to Keno, are grown up with tules and other aquatic plants. They will ultimately be drained and large areas of very fertile land thus be made suitable for agriculture. For the purpose of making a general study of the level of the water surface in this territory three gages were established:

Gage No. 1, located 4 miles below Klamath Falls, was established June 20, 1906. The elevation of the zero of the gage is 4,079.86 feet above sea level.

Gage No. 2, at Lee's ranch, 12 miles below Klamath Falls, was established December 19, 1906. The elevation of the zero of the gage is 4,075.04. As this gage is inaccessible during high water it has not been possible to obtain continuous records.

Gage No. 3, at Teeter's landing, 17 miles below Klamath Falls, was established December 19, 1906. The elevation of the zero of the gage is 4,079.44.

Daily gage height, in feet, of Klamath River 4 miles below Klamath Falls, Oreg., for 1907 and 1908.

[R. R. Brewbaker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.8		6.8	7.35	7.5	7.0	6.4	5.55				
2	5.8		6.8	7.4					5.2		5.2	
3	5.8			7.4	7.4	7.0	6.4	5.5		5.1		5.4
4	5.8		9.0						5.15		5.2	
5			9.0	7.5	7.5		6.3	5.45		5.1		
6			9.0	7.5		7.0			5.15			5.5
7	5.8		9.0		7.5		6.25	5.4		5.1	5.25	
8	5.8		9.0	7.5		6.9	6.25					
9	5.8		9.9	7.5			6.2		5.15	5.1	5.25	5.4
10	5.8			7.5				5.35				
11			7.0		7.4	6.9	6.2		5.2	5.1	5.3	
12		6.2		7.5				5.35		5.1		5.5
13		6.3			7.35	6.85		5.35				
14	5.8	6.3		7.55	7.4				5.15	5.1	5.25	5.55
15	5.8	6.3			7.4	6.8	6.0					
16	5.8	6.3			7.35			5.3	5.1		5.3	5.55
17	5.8	6.2			7.3		5.95	5.25		5.1		
18	5.8	6.7		7.55	7.3		5.95		5.1		5.25	
19	5.8	6.7				6.8		5.25		5.1		
20	5.8	6.7		7.55	7.25		5.9		5.1		5.3	5.55
21	5.8	6.7			7.2				5.1	5.1		
22	5.8	6.8		7.6	7.2	6.65	5.8	5.15				
23	5.8	6.8					5.8				5.3	5.6
24	5.8			7.5	7.2	6.6		5.25	5.1	5.15		
25	5.8	9.0			7.15		5.75				5.35	
26	5.8	6.8		7.5		6.55	5.7			5.15		5.85
27	5.8		7.2				5.7	5.2	5.0		5.35	
28		6.8	7.3		7.1					5.2		5.8
29			7.3	7.5	7.1	6.5	5.65		5.0			
30			7.3		7.1		5.65	5.2			5.35	5.95
31			7.35				5.6	5.2		5.15		
1908.												
1		6.2	6.15			5.85	5.3	4.75		4.4		
2	5.9			6.15	6.1				4.4			
3		6.3	6.15			5.8	5.2	4.7		4.4	5.1	5.25
4	5.9			6.15	6.0							
5		6.25	6.15					4.7	4.35			5.3
6	5.95			6.15		5.7					5.1	
7			6.15		6.0		5.2		4.4	4.5		
8		6.4		6.15	6.0	5.75		4.65				
9	6.0		6.15				5.1					5.3
10		6.15			5.95			4.65	4.3	4.6	5.1	
11	5.95	6.2	6.15	6.15		5.7	5.1					
12					6.0				4.35	4.65		5.25
13	6.0					5.7	5.1	4.65				
14		6.2	6.1	6.1					4.35		5.15	
15	6.0	6.2			6.0	5.7	5.0	4.65				5.3
16			6.15					4.65		4.9		
17		6.2		6.2		5.6			4.4		5.2	
18	6.05		6.1	6.1	5.95		5.0					5.4
19		6.15						4.6	4.4			
20	6.05	6.15			5.95	5.8	5.0			5.0		
21			6.1	6.2							5.2	5.4
22		6.15				5.4		4.55	4.4			
23	6.15		6.1	6.15	5.9		4.95			5.0	5.25	
24						5.55		4.55	4.4			5.35
25	6.1	6.15		6.1	5.85							
26			6.1					4.5	4.4	5.0	5.2	5.35
27	6.15	6.15		6.0		5.4	4.86			5.05		
28			6.1		5.9	5.35					5.25	
29							4.8	4.45				
30	6.15			6.15	5.85							5.4
31			6.1					4.45				

Daily gage height, in feet, of Klamath River 12 miles below Klamath Falls, Oreg., for 1907 and 1908.

[Mrs. J. P. Lee and Arthur Sevits, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	10.5	10.8	11.7	12.1						10.0	10.1	10.3
2	10.6	10.9	11.7	12.1						10.0	10.1	10.3
3	10.7	11.0	11.7	12.2						10.0	10.1	10.3
4	10.8	11.0	11.7	12.2						10.0	10.1	10.3
5	10.7	11.1	11.7	12.2						10.0	10.1	10.3
6	10.7	11.1	11.	12.2						10.0	10.1	10.3
7	10.7	11.2	11.7							10.0	10.1	10.3
8	10.7	11.2	11.8							10.0	10.1	10.3
9	10.7	11.2	11.8							10.0	10.2	10.3
10	10.7	11.3	11.8							10.0	10.2	10.3
11	10.7	11.4	11.9							10.0	10.2	10.3
12	10.7	11.4	11.8							10.0	10.2	10.3
13	10.7	11.4	11.8							10.0	10.2	10.3
14	10.7	11.4	11.8							10.0	10.2	10.3
15	10.7	11.4	11.8							10.0	10.2	10.3
16	10.7	11.5	11.8							10.0	10.2	10.3
17	10.7	11.5	11.9							10.0	10.2	10.3
18	10.7	11.5	12.1							10.0	10.2	10.3
19	10.7	11.5	12.1							10.0	10.2	10.3
20	10.7	11.5	12.0							10.0	10.2	10.3
21	10.7	11.5	12.1							10.0	10.2	10.3
22	10.7	11.6	12.0							10.0	10.2	10.4
23	10.7	11.6	12.1							10.0	10.2	10.4
24	10.7	11.7	12.1							10.0	10.2	10.5
25	10.7	11.7	12.1							10.1	10.3	10.5
26	10.7	11.7	12.1							10.1	10.3	10.5
27	10.7	11.7	12.1							10.1	10.3	10.5
28	10.8	11.7	12.1							10.1	10.3	10.5
29	10.8		12.1							10.1	10.3	10.5
30	10.8		12.1							10.1	10.3	10.5
31	10.8		12.1							10.1		10.5
1908.												
1	10.7	11.2	11.1	11.2				9.8				
2	10.7	11.2	11.2	11.2								
3	10.8	11.2	11.2	11.2								
4	10.8	11.2	11.2	11.2			10.15					
5	10.9	11.2	11.2	11.2								
6	10.9	11.2	11.2	11.2		10.6			9.4			
7	10.9	11.2	11.2	11.2								
8	10.9	11.2	11.2	11.2				9.7				
9	10.9	11.2	11.2	11.2								
10	11.0	11.2	11.2	11.2			10.0					
11	11.0	11.2	11.2	11.2								
12	11.0	11.2	11.2	11.2								
13	11.0	11.2	11.2	11.2		10.55			9.5			
14	11.0	11.2	11.2	11.2								
15	11.0	11.2	11.2	11.2				9.6				
16	11.0	11.2	11.2	11.2								
17	11.1	11.2	11.2									
18	11.1	11.2	11.2				9.9					
19	11.1	11.2	11.2									
20	11.1	11.2	11.2			10.4						
21	11.1	11.2	11.2									
22	11.1	11.2	11.2					9.6				
23	11.1	11.1	11.2									
24	11.1	11.1	11.2		10.8							
25	11.1	11.1	11.2				9.8					
26	11.1	11.1	11.2									
27	11.1	11.1	11.2			10.3						
28	11.1	11.2	11.2									
29	11.1	11.2	11.2									
30	11.2		11.2		10.7			9.5				
31	11.2		11.2									

Daily gage height, in feet, of Klamath River 17 miles below Klamath Falls, Oreg., for 1907 and 1908.

[G. W. Kegg and Mrs. L. C. Ady, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.07	6.20	7.10	7.60	7.80	7.40	6.80	6.00	5.58	5.48	.....	5.80
2	6.10	6.25	7.10	7.60	7.80	7.40	6.75	5.90	5.58	5.50	5.60	5.80
3	6.12	6.30	7.12	7.63	7.75	7.35	6.73	5.90	5.58	5.50	5.60	5.85
4	6.27	6.45	7.12	7.80	7.75	7.33	6.70	5.90	5.58	5.50	5.60	5.85
5	6.30	6.47	7.15	7.75	7.80	7.30	6.68	5.90	5.58	5.50	5.60	5.85
6	6.15	6.50	7.17	7.65	7.75	7.32	6.65	5.83	5.58	5.50	5.60	5.85
7	6.15	6.55	7.20	7.65	7.75	.....	6.60	5.70	5.55	5.50	5.60	5.80
8	6.12	6.60	7.20	7.70	7.75	7.25	6.60	5.75	5.55	5.50	5.65	5.80
9	6.10	6.65	7.25	7.70	7.80	7.20	6.60	5.78	5.55	5.53	5.67	5.80
10	6.15	6.70	7.25	7.70	7.90	7.20	6.56	5.80	5.55	5.50	5.70	5.80
11	6.15	6.72	7.25	7.70	7.75	7.25	6.52	5.80	5.55	5.50	5.70	5.80
12	6.15	6.77	7.22	7.75	7.65	7.22	6.50	5.75	5.50	5.50	5.70	5.90
13	6.15	6.80	7.22	7.80	7.70	.....	.....	5.75	5.50	5.50	.....	5.90
14	6.15	6.80	7.22	7.80	7.70	.....	6.45	5.75	5.50	5.53	5.70	5.90
15	6.15	6.85	7.27	7.80	7.70	.....	6.40	5.72	5.50	5.53	5.70	5.90
16	6.17	6.90	7.25	7.80	7.65	7.22	6.37	5.70	5.65	5.53	5.70	5.90
17	6.17	6.90	7.30	7.75	7.65	7.22	6.35	.....	5.48	5.53	.....	5.90
18	6.17	6.90	7.50	7.80	7.60	7.22	6.32	5.68	5.48	5.53	5.70	5.90
19	6.20	6.92	7.35	7.80	7.60	7.19	6.30	5.68	5.48	5.53	5.72	6.00
20	6.20	6.95	7.45	7.90	7.60	7.19	6.30	5.65	5.50	5.53	5.72	5.90
21	6.20	6.97	7.42	7.90	7.45	.....	6.23	5.62	5.48	5.53	5.72	5.90
22	6.20	7.00	7.47	7.80	7.50	.....	6.20	5.60	5.48	5.53	5.75	5.90
23	6.20	7.00	7.55	7.80	7.50	7.00	6.20	5.58	5.50	5.55	5.75	6.00
24	6.20	7.05	7.50	7.80	7.50	7.00	6.17	5.70	5.48	5.55	5.75	6.00
25	6.20	7.00	7.50	7.85	7.50	6.97	6.15	5.65	5.50	5.55	5.75	6.00
26	6.20	7.05	7.50	7.85	7.50	6.95	6.10	5.65	5.45	5.57	5.75	6.20
27	6.17	7.05	7.50	7.85	7.40	6.94	6.10	5.60	5.40	5.57	5.75	6.15
28	6.15	7.10	7.50	7.80	7.40	6.94	6.10	5.63	5.40	5.59	5.75	6.20
29	6.15	.....	7.55	7.80	7.40	6.87	6.10	5.63	5.40	5.60	5.75	6.22
30	6.15	.....	7.60	7.80	7.40	6.80	6.10	5.63	5.50	5.60	5.80	6.20
31	6.10	.....	7.60	.....	7.40	.....	6.00	5.60	.....	5.60	.....	6.20
1908.												
1	6.20	.....	6.51	6.50	.....	.....	5.75	.....	4.95	4.98	.....	.....
2	6.20	6.58	.....	6.50	.....	.....	5.74	.....	4.95	5.05	.....	.....
3	6.20	6.59	6.53	6.50	.....	.....	5.72	.....	4.92	5.08	.....	.....
4	6.20	6.60	6.52	6.50	6.41	.....	5.70	.....	4.96	4.98	.....	.....
5	6.22	.....	6.52	.....	6.41	6.14	5.70	.....	4.95	5.00	.....	.....
6	6.30	.....	6.52	.....	.....	6.12	5.69	.....	4.96	5.00	5.54	.....
7	6.31	6.55	6.52	.....	.....	6.10	5.68	.....	4.90	5.01	5.55	.....
8	.....	.....	6.52	6.50	.....	6.18	5.67	.....	4.88	5.05	5.55	.....
9	.....	6.55	6.51	6.50	.....	6.10	5.64	.....	4.85	5.02	.....	.....
10	6.31	6.55	6.51	6.51	.....	6.10	5.62	.....	4.85	5.05	.....	.....
11	6.32	.....	6.51	6.51	.....	6.09	5.59	.....	4.87	5.06	.....	.....
12	6.32	.....	6.50	6.51	.....	6.08	.....	.....	4.88	5.10	.....	.....
13	6.32	6.57	6.50	6.51	6.42	6.06	.....	.....	4.89	5.35	.....	.....
14	.....	6.58	6.50	6.51	6.42	6.02	.....	.....	4.85	5.36	.....	.....
15	6.37	6.58	6.49	6.51	.....	6.00	.....	5.15	4.85	5.38	.....	.....
16	6.37	6.52	6.49	6.51	6.41	.....	.....	5.10	4.86	5.39	.....	.....
17	6.40	6.52	.....	6.51	.....	.....	.....	5.10	4.88	5.40	.....	.....
18	6.40	6.53	.....	6.51	6.41	.....	.....	5.10	4.89	5.41	.....	.....
19	6.46	.....	6.49	6.52	6.41	5.98	.....	5.10	4.89	5.45	.....	.....
20	6.46	6.53	6.49	6.52	.....	5.90	.....	5.05	4.90	5.50	.....	.....
21	6.47	6.55	6.50	6.53	.....	.....	.....	5.05	4.92	5.48	.....	.....
22	6.47	6.55	6.49	.....	6.40	5.90	.....	5.05	4.95	5.46	.....	.....
23	6.48	6.55	6.49	.....	.....	5.90	.....	5.05	4.96	5.48	.....	.....
24	6.50	6.53	.....	.....	.....	5.90	.....	5.00	4.95	5.50	.....	.....
25	6.50	6.53	.....	6.47	.....	5.90	.....	4.96	4.95	5.50	.....	.....
26	6.50	6.52	.....	6.45	.....	.....	.....	5.00	4.92	5.50	.....	.....
27	6.50	.....	.....	.....	6.40	5.80	.....	4.80	4.95	5.50	.....	.....
28	6.50	.....	6.47	.....	6.40	5.78	.....	4.85	4.95	5.50	.....	.....
29	.....	.....	.....	6.44	.....	5.76	.....	4.90	4.96	5.50	.....	.....
30	.....	.....	.....	.....	.....	5.76	.....	4.95	4.98	5.50	.....	.....
31	.....	.....	6.50	.....	.....	.....	.....	4.95	.....	5.50	.....	.....

KLAMATH RIVER AT KENO, OREG.

This station, which is located at the county bridge over Klamath River at the lower end of the lakes and marshes that form the headwaters of Klamath River, was established May 31, 1904, to obtain data for reclamation projects. The United States Reclamation Service is at present reclaiming lands for irrigation in two ways—by diverting waters from Klamath Lake and by draining the large swamp areas bordering this stream and the lakes which are tributary to it. Immediately below the station the river breaks over a rocky ledge with a fall of about 200 feet to the mile.

During the winter the river usually freezes over, but as the water is comparatively deep and the ice is not very thick the records have not been greatly affected by the ice. At low stages a growth of aquatic plants clogs the section and to some extent lessens the accuracy of the results. An additional source of error has resulted from the effect of wind on the wide expanse of water above the station. A strong upstream wind will blow the water back from the outlet and diminish the flow, but as the gage is located at the bridge, 1,000 feet above the gaging site, gage heights are not always affected to a corresponding degree. The datum of the gage has not been changed since it was installed.

Discharge measurements of Klamath River at Keno, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 19	L. F. Hendricks	432	3,970	13.55	3,240
March 13	do	435	4,110	13.80	3,760
April 2	do	445	4,260	14.10	4,550
April 16	do	450	4,360	14.25	4,880
May 23	J. C. Stevens	425	4,250	14.06	4,420
June 1	C. E. Ellsworth	440	4,150	13.90	4,230
June 15	do	435	3,960	13.65	3,650
June 29	do	435	3,870	13.45	3,160
July 22	do	420	3,640	12.90	2,240
July 29	do	410	3,560	12.75	1,970
August 19	do	410	3,370	12.40	1,540
September 2	do	405	3,380	12.30	1,450
September 21	do	401	3,320	12.20	1,240
October 3	do	403	3,370	12.25	1,350
October 25	do	403	3,370	12.30	1,430
November 4	do	408	3,420	12.37	1,470
November 14	do	410	3,430	12.40	1,520
1908.					
February 18	C. E. Ellsworth	427	3,770	13.20	2,690
March 6	do	427	3,790	13.17	2,580
April 1	do	430	3,750	13.15	2,520
April 17	do	427	3,770	13.19	2,560
May 5	Ellsworth and Kimble	421	3,670	13.02	2,400
May 22	H. Kimble	415	3,650	12.90	2,570
June 12	do	415	3,620	12.80	2,260
July 14	do	395	3,340	12.25	1,450
September 1	do	405	3,190	11.70	704
September 17	do	405	3,130	11.60	789
October 1	do	397	3,120	11.55	1,130
October 27	do	409	3,570	12.20	1,250
November 29	Kimble and McGlashan	413	3,660	12.38	1,460

Daily gage height, in feet, of Klamath River at Keno, Oreg., for 1907 and 1908.

[T. A. Grubb, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	12.70	12.90	13.70	14.10	14.30	13.92	13.40	12.65	12.35	12.22	12.40	12.50
2	12.70	13.00	13.70	14.10	14.30	13.90	13.37	12.60	12.30	12.25	12.33	12.50
3	12.70	13.10	13.70	14.10	14.30	13.88	13.35	12.55	12.30	12.21	12.44	12.50
4	12.70	13.10	13.70	14.30	14.30	13.86	13.32	12.54	12.30	12.20	12.37	12.50
5	12.70	13.20	13.80	14.20	14.30	13.84	13.30	12.52	12.27	12.20	12.38	12.50
6	12.70	13.20	13.80	14.20	14.30	13.81	13.25	12.50	12.25	12.20	12.39	12.52
7	12.70	13.30	13.80	14.20	14.30	13.80	13.23	12.49	12.25	12.22	12.39	12.38
8	12.70	13.30	13.80	14.20	14.30	13.79	13.21	12.48	12.25	12.23	12.39	12.50
9	12.80	13.40	13.80	14.30	14.30	13.77	13.20	12.47	12.25	12.23	12.39	12.50
10	12.80	13.40	13.80	14.30	14.20	13.75	13.18	12.47	12.25	12.25	12.40	12.50
11	12.80	13.40	13.80	14.30	14.20	13.73	13.16	12.45	12.25	12.25	12.40	12.50
12	12.80	13.40	13.80	14.30	14.10	13.73	13.15	12.45	12.24	12.25	12.40	12.60
13	12.80	13.40	13.80	14.30	14.20	13.73	13.13	12.43	12.24	12.25	12.40	12.60
14	12.80	13.50	13.80	14.30	14.20	13.71	13.10	12.42	12.23	12.25	12.40	12.60
15	12.80	13.50	13.80	14.20	14.20	13.69	13.05	12.41	12.23	12.25	12.40	12.60
16	12.80	13.50	13.80	14.30	14.20	13.66	13.02	12.40	12.23	12.25	12.40	12.60
17	12.80	13.50	13.90	14.30	14.20	13.64	13.00	12.40	12.23	12.25	12.40	12.63
18	12.80	13.50	14.10	14.30	14.20	13.62	12.98	12.39	12.23	12.25	12.40	12.63
19	12.80	13.50	14.00	14.40	14.10	13.60	12.95	12.39	12.22	12.30	12.40	12.64
20	12.80	13.60	14.00	14.40	14.10	13.58	12.92	12.37	12.22	12.30	12.42	12.65
21	12.80	13.60	14.00	14.30	14.10	13.56	12.91	12.35	12.20	12.30	12.43	12.65
22	12.80	13.60	14.00	14.30	14.10	13.55	12.90	12.33	12.20	12.30	12.46	12.66
23	12.80	13.60	14.00	14.30	14.00	13.54	12.87	12.30	12.20	12.30	12.48	12.69
24	12.80	13.60	14.00	14.30	14.00	13.53	12.85	12.30	12.20	12.30	12.48	12.73
25	12.80	13.70	14.00	14.30	13.98	13.53	12.82	12.31	12.17	12.30	12.49	12.78
26	12.80	13.70	14.00	14.30	13.96	13.51	12.80	12.31	12.15	12.30	12.49	12.90
27	12.80	13.70	14.00	14.30	13.95	13.50	12.78	12.31	12.15	12.30	12.49	12.90
28	12.90	13.70	14.00	14.30	13.94	13.47	12.76	12.31	12.15	12.36	12.49	12.89
29	12.90	.....	14.10	14.30	13.93	13.45	12.75	12.32	12.17	12.37	12.50	12.90
30	12.90	.....	14.10	14.30	13.93	13.42	12.72	12.32	12.20	12.30	12.50	12.90
31	12.90	.....	14.10	.....	13.93	.....	12.70	12.34	.....	12.30	.....	12.90
1908.												
1	12.90	13.10	13.20	13.15	13.00	12.80	12.50	11.97	11.66	11.55	12.22	12.41
2	12.92	13.10	13.17	13.15	13.00	12.75	12.50	11.95	11.66	11.50	12.23	12.41
3	12.95	13.10	13.19	13.13	13.00	12.75	12.45	12.00	11.64	11.63	12.25	12.41
4	12.95	13.15	13.19	13.15	13.00	12.80	12.42	12.00	11.65	11.65	12.30	12.45
5	12.97	13.17	13.19	13.15	13.00	12.80	12.40	12.00	11.65	11.70	12.28	12.46
6	12.99	13.27	13.19	13.16	13.00	12.80	12.39	12.00	11.63	11.75	12.28	12.47
7	13.00	13.22	13.19	13.17	13.00	12.80	12.40	12.00	11.61	11.75	12.29	12.47
8	13.00	13.30	13.19	13.19	13.00	12.80	12.36	12.00	11.55	11.75	12.30	12.46
9	13.00	13.27	13.19	13.19	12.99	12.79	12.32	11.95	11.58	11.70	12.30	12.45
10	13.00	13.20	13.19	13.19	12.99	12.79	12.30	11.90	11.60	11.80	12.30	12.45
11	13.00	13.20	13.19	13.19	12.99	12.80	12.30	11.85	11.60	11.80	12.30	12.44
12	13.00	13.19	13.19	13.19	12.99	12.79	12.25	11.89	11.60	11.82	12.30	12.43
13	13.00	13.20	13.19	13.19	12.99	12.79	12.20	11.80	11.60	11.80	12.30	12.43
14	13.00	13.20	13.17	13.19	12.98	12.75	12.20	11.82	11.58	12.20	12.31	12.44
15	13.02	13.20	13.17	13.19	12.97	12.70	12.15	11.82	11.59	12.10	12.31	12.45
16	13.04	13.20	13.15	13.19	13.00	12.65	12.15	11.82	11.60	12.05	12.35	12.46
17	13.08	13.20	13.00	13.20	13.01	12.63	12.15	11.82	11.60	12.10	12.36	12.47
18	13.09	13.20	13.17	13.15	12.95	12.61	12.15	11.80	11.64	12.15	12.40	12.48
19	13.09	13.19	13.17	13.17	12.96	12.59	12.15	11.80	11.60	12.00	12.40	12.49
20	13.10	13.20	13.15	13.20	12.99	12.60	12.13	11.79	11.62	12.10	12.30	12.49
21	13.10	13.20	13.15	13.20	12.95	12.59	12.11	11.75	11.65	12.15	12.39	12.49
22	13.13	13.20	13.15	13.10	12.96	12.59	12.10	11.71	11.65	12.15	12.35	12.49
23	13.15	13.20	13.10	13.19	12.97	12.59	12.09	11.71	11.66	12.20	12.33	12.49
24	13.17	13.20	13.90	13.10	12.95	12.59	12.06	11.71	11.67	12.20	12.32	12.49
25	13.17	13.17	13.50	13.10	12.95	12.57	12.00	11.71	11.68	12.20	12.33	12.49
26	13.16	13.15	13.50	13.10	12.85	12.45	12.02	11.71	11.69	12.20	12.35	12.49
27	13.15	13.15	13.70	13.10	12.90	12.50	12.04	11.60	11.70	12.25	12.40	12.49
28	13.15	13.17	13.10	13.10	12.90	12.50	12.05	11.62	11.70	12.30	12.40	12.50
29	13.15	13.20	13.10	13.09	12.90	12.50	12.04	11.64	11.69	12.25	12.40	12.50
30	13.15	.....	13.00	13.09	12.80	12.45	12.20	11.66	11.68	12.20	12.41	12.50
31	13.15	.....	13.10	.....	12.80	.....	12.00	11.68	.....	12.20	.....	12.50

NOTE.—River frozen over from February 1 to 8, 1908; ice 4 inches thick.

Rating table for Klamath River at Keno, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
11.50	730	12.30	1,390	13.10	2,520	13.90	4,080
11.60	780	12.40	1,510	13.20	2,690	14.00	4,300
11.70	840	12.50	1,630	13.30	2,870	14.10	4,530
11.80	900	12.60	1,760	13.40	3,060	14.20	4,760
11.90	970	12.70	1,900	13.50	3,250	14.30	4,990
12.00	1,060	12.80	2,050	13.60	3,450	14.40	5,220
12.10	1,160	12.90	2,200	13.70	3,660		
12.20	1,270	13.00	2,360	13.80	3,870		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on twenty-four discharge measurements made during 1906 to 1908, and is fairly well defined.

Monthly discharge of Klamath River at Keno, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	2,200	1,900	2,030	125,000	B.
February	3,660	2,200	3,120	173,000	A.
March	4,530	3,660	4,070	250,000	A.
April	5,220	4,530	4,920	293,000	A.
May	4,990	4,150	4,630	285,000	A.
June	4,120	3,100	3,600	214,000	A.
July	3,060	1,900	2,430	149,000	A.
August	1,830	1,390	1,530	94,100	B.
September	1,450	1,220	1,310	78,000	B.
October	1,470	1,270	1,350	83,000	B.
November	1,630	1,430	1,540	91,600	B.
December	2,200	1,490	1,820	112,000	B.
The year	5,220	1,220	2,700	1,950,000	
1908.					
January	2,640	2,200	2,450	151,000	B.
February	2,870	2,520	2,670	154,000	B.
March	4,080	2,360	2,730	168,000	B.
April	2,690	2,500	2,610	155,000	B.
May	2,380	2,050	2,300	141,000	C.
June	2,050	1,570	1,870	111,000	C.
July	1,630	1,060	1,290	79,300	C.
August	1,060	780	925	56,900	C.
September	840	755	801	47,700	C.
October	1,390	730	1,070	65,800	B.
November	1,520	1,290	1,420	84,500	B.
December	1,630	1,520	1,590	97,800	B.
The year	4,080	730	1,810	1,310,000	

NOTE.—The open-channel rating table has been applied throughout the year; discharges for February, 1908, and possibly for short periods at other times, may be somewhat too large on account of ice.

WILLIAMSON RIVER NEAR KLAMATH AGENCY, OREG.

This station, which is located 13 miles northeast of the Klamath Agency at a point locally known as Rocky Ford, at the lower extremity of Klamath Marsh, was established March 26, 1908, in cooperation with the United States Indian Service. It is expected that a portion of the lands in the Klamath Reservation can be reclaimed by irrigation and also by the drainage of tributary swamp areas.

The nearest tributary is Spring Creek, 11 miles below the station. Owing to the inaccessibility of the station, continuous records have

not been possible. During the winter months it is almost impossible to reach the station on account of snow.

On October 17, 1908, a Bristol self-registering gage was installed, and as this only required weekly visits by the observer, continuous records were obtained during the remainder of the year. Owing to the large storage capacity in Klamath Marsh the river is not subject to great fluctuations. It is probable that weekly observations will give sufficient data for an estimate of the flow.

The accuracy of the results is somewhat affected by the growth of aquatic plants in the river channel during the season, and a comparatively large number of measurements will be necessary in order to secure reliable results. The data herewith were obtained by usual methods, using a mean curve.

Discharge measurements of Williamson River near Klamath Agency, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 26	C. E. Ellsworth	121	379	2.29	792
March 27	do	121	386	2.30	824
April 28	do	115	314	1.56	505
May 15	H. Kimble	100	270	1.33	351
June 19	do	95	236	.90	248
July 16	do	95	224	.82	162
September 26	do	80	166	.48	67
October 17	do	102	228	1.00	184
November 20	McGlashan and Kimble	100	241	1.09	278

Daily gage height, in feet, of Williamson River near Klamath Agency, Oreg., for 1908.

[Herbert Nelson, observer.]

Day.	Mar.	Apr.	Sept.	Oct.	Nov.	Dec.	Day.	Mar.	Apr.	Sept.	Oct.	Nov.	Dec.
1		2.27		0.50	1.05	1.04	16		1.86		0.90	1.04	0.90
2		2.26		.50	1.04	1.05	17		1.78		1.00	1.08	.85
3		2.24		.50	1.04	1.04	18		1.74		1.00	1.10	.80
4		2.20		.50	1.03	1.02	19		1.71		1.00	1.10	.98
5		2.18		.50	1.02	.95	20		1.70		1.00	1.08	1.06
6		2.16		.50	1.02	.91	21		1.69		1.00	1.07	1.06
7		2.14		.50	1.02	.94	22		1.65		1.00	1.09	1.05
8		2.14		.50	1.00	.99	23		1.64		1.00	1.11	1.04
9		2.12		.50	1.00	.91	24				1.01	1.13	1.03
10		2.08		.50	1.00	.90	25	2.32			1.01	1.15	1.02
11		2.05		.60	1.02	.87	26	2.30		0.50	1.01	1.09	1.03
12		2.02		.60	1.03	1.02	27	2.30		.50	1.02	1.06	1.03
13		1.96		.60	1.03	1.03	28	2.31	1.56	.50	1.02	1.04	1.03
14		1.92		.70	1.05	1.00	29	2.30		.50	1.01	1.06	1.03
15		1.90		.80	1.04	.96	30	2.30		.50	1.01	1.07	1.03
							31	2.28			1.03		

Rating table for Williamson River near Klamath Agency, Oreg., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	72	1.00	239	1.50	450	2.00	674
.60	100	1.10	279	1.60	494	2.10	720
.70	130	1.20	320	1.70	539	2.20	766
.80	165	1.30	362	1.80	584	2.30	812
.90	201	1.40	406	1.90	629	2.40	858

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on nine discharge measurements made in 1908, and is fairly well defined.

Monthly discharge of Williamson River near Klamath Agency, Oreg., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 25–31	821	803	813	11,300	A.
April	798	464	621	37,000	B.
May			375	23,100	C.
June			201	12,000	C.
July			172	10,600	C.
August			130	7,990	C.
September			86	5,120	C.
October	251	72	166	10,200	B.
November	300	239	261	15,500	B.
December	263	165	235	14,400	B.
The period				147,000	

NOTE.—Discharges for May to September have been estimated from the gage heights taken at time of measurements.

LOST RIVER NEAR CLEAR LAKE, CAL.

This station, which was established September 1, 1904, is located 13 miles from Langell, Oreg., at the outlet of Clear Lake, 1 mile below the mouth of Willow Creek.

Clear Lake is the site of a reservoir, and a dam at the outlet is now being constructed by the United States Reclamation Service, where it is proposed to store the flood and winter flow of the stream for irrigation. The reservoir will hold three years' run-off.

In the winter months the stream is frequently frozen for weeks at a time, and for such periods the records are not reliable. Until construction work was begun on the dam it was almost impossible to procure gage observations with any degree of regularity. A Frieze automatic water register was established November 4, 1905, which required weekly visits by the observer, but as he was compelled to ride 12 miles to change the record sheets, it was not always possible for him to do so. Where missing records could be estimated with a reasonable degree of accuracy, it has been done.

The conditions at the station during low stages of the river are not conducive to accurate results. The channel is obstructed by the growth of weeds and aquatic plants, and a large number of measure-

ments are required for reliable estimates of flow. At such times, however, the discharge is very low, so that the total run-off can be accepted with safety.

Discharge measurements of Lost River near Clear Lake, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	Hendricks and Sticksel	130	196	7.25	444
January 31	do	130	208	7.30	497
February 6	L. F. Hendricks	163	522	9.80	2.230
February 10	do	146	371	8.50	1.170
March 6	do	140	271	7.80	782
April 12	do	150	395	8.70	1,280
April 24	do	130	195	7.20	491
May 13	Stevens and Ellsworth	125	117	6.60	235
June 4	C. E. Ellsworth	70	54	5.90	67
June 23	do	63	40	5.68	39
July 26	do	16	12	5.25	13
August 14	do	12	10	5.27	11
September 6	do	10	8.8	5.20	8.7
September 25	do	9	10	5.25	11
October 14	do	18	12	5.38	12
October 21	do	16	12	5.35	14
1908.					
February 21	C. E. Ellsworth	53	32	5.55	32
April 8	do	63	52	5.80	71
May 2	Kimble and Ellsworth	19	14	5.25	17
May 19	H. Kimble	30	28	5.70	36
June 25	do	7	6.6	4.84	5.2
July 25	do	8	8.2	5.00	7.1
September 3	do	10	5.8	4.80	2.5
October 8	do	6	12.4	5.20	8.6
October 23	do	6	12.8	5.24	11
November 25	Kimble and McGlashan	14	11 8	5.23	10.8

Daily gage height, in feet, of Lost River near Clear Lake, Cal., for 1907 and 1908.

[A. C. Duncan and R. M. Boller, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.00	7.35	7.80	9.35	6.75		5.42	5.30	5.20			5.40
2	7.00	7.90	7.80	9.40	6.65		5.39	5.29				5.38
3	6.90	9.20	7.80	9.30	6.60	5.72	5.37	5.28			5.55	5.37
4	6.90	10.50	7.75	9.20	6.55	5.68	5.35	5.28				5.39
5	6.90	10.10	8.00	9.10	6.55	5.64	5.33					5.40
6	6.90	9.70	7.85	8.90		5.60	5.30		5.20			5.43
7	6.90	9.45	7.70	8.90		5.59	5.28		5.20			5.47
8	6.90	8.95	7.90	9.05		5.60	5.30		5.20			5.49
9	6.90	8.70	7.90	9.00		5.80	5.30		5.20			
10	6.90	8.50	7.85	8.85		5.70	5.30		5.20			
11	6.90	8.40	7.80	8.75		5.68	5.34	5.40	5.18			
12	6.90	8.25	7.65	8.70	6.60	5.70	5.40	5.38	5.16			
13	6.90	8.15	7.60	8.70	6.60		5.40	5.35	5.16	5.40		
14	6.80	8.05	7.50	8.65	6.60			5.33	5.16	5.40		
15	6.70	7.95	7.50	8.55	6.58			5.30	5.16	5.39		5.58
16	6.60	7.90	7.55	8.45	6.55	6.30		5.27		5.37		5.55
17	6.50	7.80	8.60	8.35	6.50	6.12		5.20		5.36	5.40	5.46
18	6.40	7.80	9.30	8.25	6.45	6.04		5.13		5.35		5.44
19	6.30	7.75	10.00	8.15	6.38	5.95				5.35		5.41
20	6.30	7.75	10.10	8.05	6.38	5.85				5.35		5.40
21	6.30	7.80	10.00	7.65	6.40	5.78	5.27		5.30	5.35		5.46
22	6.30	8.10	10.00	7.55	6.40	5.70	5.27		5.30			5.45
23	6.30	8.00	9.80	7.40	6.40	5.69	5.25		5.30			6.30
24	6.30	8.00	9.75	7.30	6.38	5.66	5.24		5.30		5.50	6.90
25	6.00	8.15	9.70	7.20	6.35	5.63	5.23	5.38	5.30			6.78

Daily gage height, in feet, of Lost River near Clear Lake, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	5.70	8.00	9.50	7.15	6.23	5.61	5.24	5.35	5.30	.....	.....	6.70
27	5.70	8.05	9.40	7.05	6.20	5.58	5.26	5.30	5.30	.....	.....	6.62
28	5.70	8.00	9.30	6.90	6.17	5.53	5.30	5.24	5.34	.....	.....	6.55
29	6.60	.....	9.30	6.85	6.12	5.51	5.30	5.19	.....	.....	.....	.....
30	7.50	.....	9.60	6.85	6.08	5.50	5.32	5.18	.....	.....	.....	.....
31	7.30	.....	9.50	.....	6.04	.....	5.31	5.18	.....	.....	.....	.....
1908.												
1	.....	.....	.....	5.42	5.25	5.26	4.84	5.02	4.80	.....	5.16	5.18
2	.....	5.90	.....	5.48	5.24	5.22	4.84	5.01	4.80	.....	5.16	5.17
3	.....	.....	.....	5.52	5.21	5.20	4.84	.....	4.80	.....	5.15	5.16
4	.....	.....	.....	5.50	5.28	5.16	4.84	.....	4.80	5.20	5.15	5.16
5	.....	.....	.....	5.55	5.36	5.18	4.84	.....	4.80	5.20	5.15	5.16
6	.....	.....	.....	.....	5.32	5.17	.....	.....	4.80	5.20	5.14	5.16
7	.....	.....	.....	.....	5.26	5.16	.....	.....	.....	5.19	5.14	5.14
8	.....	.....	5.80	5.80	5.22	.....	.....	.....	.....	5.20	5.14	5.14
9	.....	5.70	5.80	5.78	5.19	.....	.....	5.01	.....	5.20	.....	5.14
10	.....	5.70	5.82	5.77	.....	.....	.....	5.01	.....	5.21	.....	5.14
11	.....	5.68	6.00	5.77	.....	.....	.....	4.99	.....	5.25	.....	5.14
12	.....	5.67	6.50	5.78	.....	.....	.....	5.00	.....	5.30	.....	5.13
13	.....	5.64	6.90	5.78	.....	5.10	.....	4.99	5.09	5.35	.....	5.16
14	6.00	5.64	6.85	5.74	.....	5.09	.....	4.95	5.08	5.40	.....	5.16
15	6.50	5.62	6.80	5.70	.....	5.07	.....	.....	5.09	5.45	5.18	5.16
16	7.00	5.60	6.80	5.68	.....	5.04	.....	.....	5.09	5.55	5.18	5.16
17	7.00	5.60	6.80	5.67	5.64	4.99	.....	.....	5.10	5.60	5.17	.....
18	6.90	5.59	6.80	5.69	5.69	4.98	.....	.....	5.11	5.60	5.16	.....
19	6.82	5.57	6.80	5.65	5.69	4.96	.....	.....	5.12	5.40	5.17	.....
20	6.88	5.56	6.80	5.61	5.69	4.94	.....	.....	5.16	5.25	5.22	5.16
21	6.88	5.55	6.75	.....	5.70	.....	.....	.....	5.21	5.24	5.25	5.16
22	6.65	5.55	6.75	.....	5.70	.....	.....	.....	5.22	5.20	5.26	5.16
23	6.60	5.55	.....	.....	5.70	.....	.....	.....	5.20	5.14	5.29	5.16
24	6.65	5.55	.....	.....	5.70	.....	.....	.....	5.19	5.14	5.26	5.16
25	6.50	5.58	.....	.....	5.44	4.84	4.95	.....	5.19	5.14	5.25	5.16
26	6.50	5.80	.....	5.54	5.34	4.82	4.98	.....	5.20	5.14	5.22	5.16
27	6.30	5.95	.....	5.56	5.26	4.81	5.01	.....	5.20	5.13	5.22	5.18
28	6.30	6.05	.....	5.48	5.20	4.84	5.01	.....	.....	5.13	5.22	5.20
29	6.18	.....	5.65	5.39	.....	4.84	5.01	.....	.....	5.14	5.18	5.23
30	6.20	.....	5.65	5.32	.....	4.84	5.02	4.80	.....	5.15	5.18	5.26
31	.....	.....	5.50	.....	5.29	.....	5.02	4.80	.....	5.16	.....	5.29

Rating tables for Lost River near Clear Lake, Cal.

FOR 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.10	5	6.30	143	7.50	608	8.70	1,295
5.20	8	6.40	170	7.60	654	8.80	1,360
5.30	12	6.50	200	7.70	702	8.90	1,430
5.40	17	6.60	234	7.80	755	9.00	1,500
5.50	24	6.70	272	7.90	810	9.20	1,660
5.60	33	6.80	312	8.00	865	9.40	1,835
5.70	43	6.90	352	8.10	920	9.60	2,025
5.80	55	7.00	392	8.20	980	9.80	2,230
5.90	68	7.10	432	8.30	1,040	10.00	2,450
6.00	83	7.20	474	8.40	1,100	10.20	2,670
6.10	100	7.30	518	8.50	1,165	10.40	2,900
6.20	120	7.40	562	8.60	1,230	10.60	3,140

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on sixteen discharge measurements made during 1907, and is fairly well defined.

JANUARY 1, 1908, TO AUGUST 29, 1908.

4.80	4.5	5.40	24	6.00	98	6.60	252
4.90	5.7	5.50	31	6.10	118	6.70	286
5.00	7.5	5.60	40	6.20	140	6.80	320
5.10	10.4	5.70	52	6.30	164	6.90	356
5.20	14	5.80	66	6.40	191	7.00	392
5.30	18.5	5.90	81	6.50	220		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on five discharge measurements made during 1908 and earlier high-water measurements, and is fairly well defined.

Rating tables for Lost River near Clear Lake, Cal.—Continued.

AUGUST 30, 1908, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	2.5	5.10	7.0	5.30	13	5.50	22
4.90	3.5	5.20	9.3	5.40	17	5.60	29
5.00	5.0						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1908 and is fairly well defined.

Monthly discharge of Lost River near Clear Lake, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	608	43	267	16,400	B.
February	3,020	540	1,140	63,300	A.
March	2,560	608	1,360	83,600	A.
April	1,840	332	1,070	63,700	A.
May	292	90	191	11,700	B.
June	143	24	54.9	3,270	B.
July	18	9	13.0	799	B.
August	17	6	11.9	732	B.
September	14	7	9.63	573	B.
October	24	14	16.8	1,030	B.
November	28	17	22.1	1,320	B.
December	352	16	84.6	5,200	B.
The year	3,020	6	353	252,000	
1908.					
January	392	98	205	12,600	B.
February	108	36	57.1	3,280	B.
March	356	31	177	10,900	B.
April	66	19.6	43.9	2,610	B.
May	52	13.6	28.9	1,780	B.
June	16.7	4.6	9.10	541	B.
July	8.1	5.0	6.08	374	B.
August	8.1	2.5	5.82	358	D.
September	10.0	2.5	6.48	386	B.
October	29	7.7	12.0	738	B.
November	12.6	7.9	9.13	543	B.
December	12.6	7.7	8.66	532	B.
The year	392	2.5	47.4	34,600	

LOST RIVER AT OLENE, OREG.

This station was originally established May 24, 1904, and was maintained until July 30 of that year, when the bridge at which measurements were made was destroyed and the station was discontinued. It was reestablished May 20, 1907, and the records have been continuous since that date. This station replaces the one at Merrill, simultaneous records being kept a sufficient length of time to make a comparison between the two. The difference of flow is largely accounted for by the inaccuracy of the data obtained at Merrill station. A slough connecting Lost River with Klamath River joins Lost River 5 miles below the Olene station and Klamath River 2 miles below Lake Ewauna. Through this slough it is proposed to divert part of the waters from Lost River into Klamath

River, and thus reclaim lands bordering Tule Lake. At present, however, the slough has been artificially closed and the flow has been shut off for several years. Before it was diked no water flowed except during high water, the direction depending upon whether Klamath or Lost River was the higher. There is a small amount of inflow below Olene. One spring was measured April 14, 1908, giving a discharge of 2.9 second-feet, and during the irrigating season there is probably some waste water from irrigation. Nuss Lake is situated half a mile from the left bank of Lost River and 1 mile below Olene. It has no surface outlet except at flood time, but it is possible that a little water passes underground from this lake to the river during the summer months.

The conditions at this station are favorable for good results. There is a riffle controlling the flow about 200 feet below the station, where measurements are made at extreme low water by wading, the velocity at the gaging site being too sluggish at such times for good results.

Discharge measurements of Lost River at Olene, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 20	Stevens and Ellsworth	126	419	5.20	349
May 31	C. E. Ellsworth	125	413	5.05	256
June 7	do	120	389	4.90	220
June 14	do	120	389	4.88	173
June 18	do	123	411	5.03	257
June 20	do	123	407	5.05	256
June 24	do	123	396	4.98	222
June 28	do	122	382	4.85	184
July 2	do	115	380	4.80	145
July 6	do	115	371	4.75	131
July 24	do	90	115	4.65	132
July 27	do	90	115	4.65	130
August 1	do	95	352	4.58	106
August 9	do	94	104	4.60	122
August 13	do	94	104	4.62	130
August 15	do	90	96	4.60	116
August 22	do	88	89	4.60	117
September 5	do	90	92	4.62	129
September 18	do	88	94	4.62	126
September 23	do	88	95	4.62	118
September 26	do	88	93	4.62	128
October 1	do	88	94	4.63	124
October 8	do	87	90	4.63	118
October 16	do	88	92	4.63	129
November 6	do	90	94	4.70	148
November 9	do	90	92	4.70	146
November 16	do	90	90	4.68	134
1908.					
February 15	C. E. Ellsworth	122	383	4.82	186
February 19	do	122	383	4.82	176
February 26	do	122	373	4.75	173
March 16	do	131	562	6.15	958
March 17	do	135	670	7.00	1,690
March 20	do	132	575	6.30	1,120
April 10	do	127	397	4.95	238
April 14	do	116	388	4.87	205
April 22	do	122	373	4.75	168
May 1	Ellsworth and Kimble	122	369	4.70	155
May 13	H. Kimble	120	364	4.65	127
June 11	do	110	359	4.60	112
June 27	do	90	359	4.60	122
July 23	do	90	348	4.50	125
September 5	do	90	348	4.50	108
October 24	do	93	359	4.60	97
November 23	Kimble and McGlashan	104	362	4.63	109

Daily gage height, in feet, of Lost River at Olene, Oreg., for 1907 and 1908.

[A. T. Wilson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	.....	.....	.....	5.15	4.80	4.55	4.60	4.62	4.70	4.65
2	.....	.....	.....	.....	.....	5.15	4.80	4.55	4.60	4.62	4.70	4.65
3	.....	.....	.....	.....	.....	5.15	4.80	4.55	4.60	4.62	4.70	4.65
4	.....	.....	.....	.....	.....	5.15	4.80	4.55	4.60	4.62	4.70	4.65
5	.....	.....	.....	.....	.....	5.10	4.80	4.55	4.60	4.62	4.70	4.65
6	.....	.....	.....	.....	.....	5.05	4.75	4.55	4.60	4.62	4.70	4.65
7	.....	.....	.....	.....	.....	4.55	4.75	4.55	4.60	4.63	4.70	4.65
8	.....	.....	.....	.....	.....	4.80	4.75	4.55	4.60	4.64	4.70	4.65
9	.....	.....	.....	.....	.....	4.80	4.75	4.60	4.60	4.64	4.70	4.65
10	.....	.....	.....	.....	.....	4.70	4.75	4.60	4.60	4.64	4.70	4.65
11	.....	.....	.....	.....	.....	4.60	4.75	4.60	4.60	4.64	4.70	4.65
12	.....	.....	.....	.....	.....	4.60	4.75	4.60	4.60	4.64	4.70	4.65
13	.....	.....	.....	.....	.....	4.80	4.70	4.58	4.60	4.64	4.70	4.65
14	.....	.....	.....	.....	.....	4.85	4.70	4.55	4.60	4.64	4.70	4.65
15	.....	.....	.....	.....	.....	4.90	4.70	4.55	4.60	4.64	4.70	4.65
16	.....	.....	.....	.....	.....	5.00	4.70	4.50	4.60	4.64	4.70	4.65
17	.....	.....	.....	.....	.....	5.00	4.70	4.50	4.60	4.64	4.70	4.65
18	.....	.....	.....	.....	.....	4.98	4.70	4.50	4.60	4.64	4.70	4.65
19	.....	.....	.....	.....	5.20	5.05	4.70	4.50	4.60	4.64	4.70	4.65
20	.....	.....	.....	.....	5.20	5.05	4.70	4.50	4.60	4.65	4.70	4.65
21	.....	.....	.....	.....	5.20	5.05	4.70	4.60	4.60	4.65	4.70	4.65
22	.....	.....	.....	.....	5.20	5.05	4.60	4.60	4.60	4.65	4.70	4.70
23	.....	.....	.....	.....	5.25	5.05	4.60	4.60	4.60	4.65	4.70	4.70
24	.....	.....	.....	.....	5.22	5.00	4.60	4.60	4.60	4.65	4.70	4.72
25	.....	.....	.....	.....	5.25	4.95	4.60	4.60	4.62	4.65	4.70	4.88
26	.....	.....	.....	.....	5.25	4.95	4.60	4.60	4.62	4.65	4.68	4.52
27	.....	.....	.....	.....	5.25	4.90	4.60	4.60	4.62	4.70	4.65	5.90
28	.....	.....	.....	.....	5.22	4.90	4.60	4.60	4.62	4.70	4.65	5.88
29	.....	.....	.....	.....	5.22	4.85	4.60	4.60	4.62	4.70	4.65	5.65
30	.....	.....	.....	.....	5.15	4.85	4.60	4.60	4.62	4.70	4.65	5.60
31	.....	.....	.....	.....	5.15	.....	4.60	4.60	.....	4.70	.....	5.52
1908.												
1	5.40	5.20	5.00	5.28	4.70	4.80	4.50	4.50	4.50	4.50	4.60	4.75
2	5.30	5.18	5.00	5.20	4.70	4.80	4.50	4.50	4.50	4.50	4.60	4.75
3	5.20	5.05	5.00	5.20	4.65	4.80	4.50	4.55	4.50	.....	4.60	4.75
4	5.20	4.95	5.00	5.20	4.65	4.80	4.50	4.55	4.50	4.50	4.62	4.75
5	5.18	4.95	5.00	5.15	4.60	4.80	4.50	4.55	4.50	4.50	4.62	4.75
6	5.10	4.95	5.00	5.08	4.60	4.80	4.50	4.55	4.50	4.50	4.65	4.75
7	5.10	4.95	5.00	5.02	4.60	4.80	4.50	4.55	4.50	4.50	4.70	4.75
8	5.00	5.00	5.00	4.92	4.55	4.75	4.50	4.55	4.50	4.48	4.70	4.75
9	5.00	5.00	4.98	4.92	4.55	4.75	4.50	4.55	4.50	4.52	4.70	4.70
10	5.00	5.00	4.95	4.95	4.55	4.75	4.50	4.55	4.50	4.55	4.70	4.70
11	5.00	5.00	4.95	4.95	4.52	4.72	4.50	4.55	4.50	4.55	4.70	4.70
12	4.95	4.95	4.95	4.90	4.55	4.70	4.50	4.55	4.50	4.60	4.70	4.70
13	4.90	4.90	4.95	4.90	4.62	4.65	4.50	4.55	4.50	4.60	4.70	4.70
14	4.90	4.90	4.95	4.85	4.65	4.58	4.50	4.55	4.50	4.60	4.70	4.70
15	4.90	4.90	5.48	4.85	4.65	4.40	4.50	4.55	4.50	4.60	4.70	4.70
16	5.50	4.90	6.45	4.85	4.65	4.50	4.50	4.55	4.50	4.60	4.70	4.70
17	5.85	4.90	6.78	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
18	6.40	4.90	6.92	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
19	6.55	4.90	6.70	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
20	5.92	4.90	6.40	4.85	4.65	4.55	4.50	4.50	4.50	4.60	4.70	4.70
21	5.88	4.90	6.10	4.82	4.65	4.55	4.50	4.50	4.50	4.60	4.70	4.70
22	5.82	4.90	5.98	4.75	4.72	4.50	4.50	4.50	4.50	4.60	4.70	4.70
23	5.90	4.90	5.92	4.75	4.90	4.50	4.50	4.50	4.50	4.60	4.70	4.70
24	5.90	4.90	5.90	4.75	4.90	4.50	4.50	4.50	4.50	4.60	4.72	4.70
25	5.82	4.80	5.80	4.70	4.88	4.50	4.50	4.50	4.50	4.60	4.75	4.70
26	5.65	4.75	5.72	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
27	5.40	4.75	5.68	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
28	5.40	4.78	5.60	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
29	5.38	4.85	5.60	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
30	5.30	.....	5.55	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
31	5.22	.....	5.52	.....	4.85	.....	4.50	4.50	.....	4.60	.....	4.70

Rating table for Lost River at Olene, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.40	80	5.10	293	5.80	710	6.50	1,250
4.50	96	5.20	343	5.90	780	6.60	1,340
4.60	116	5.30	398	6.00	850	6.70	1,430
4.70	142	5.40	455	6.10	930	6.80	1,520
4.80	172	5.50	515	6.20	1,010	6.90	1,610
4.90	208	5.60	575	6.30	1,090	7.00	1,700
5.00	248	5.70	640	6.40	1,170		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on thirty-six discharge measurements made in 1907 and 1908, and is fairly well defined between gage heights 4.6 feet and 7.0 feet.

Monthly discharge of Lost River at Olene, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
May 19–31	370	318	350	9,020	B.
June	318	116	227	13,500	B.
July	172	116	142	8,730	B.
August	116	96	109	6,700	B.
September	121	116	117	6,960	B.
October	142	121	128	7,870	B.
November	142	129	140	8,330	B.
December	780	100	216	13,300	B.
The period				74,400	
1908.					
January	1,300	208	494	30,400	B.
February	343	157	221	12,700	B.
March	1,630	228	592	36,400	B.
April	387	142	214	12,700	B.
May	208	100	144	8,850	B.
June	172	93	126	7,500	B.
July	96	96	96.0	5,900	B.
August	106	96	101	6,210	B.
September	96	96	96.0	5,710	B.
October	116	93	110	6,760	B.
November	157	116	141	8,390	B.
December	157	142	146	8,980	B.
The year	1,630	93	207	150,000	

LOST RIVER NEAR MERRILL, OREG.

This station, which was established July 26, 1904, is located 4 miles northwest of Merrill and 7 miles above the junction of the river with Tule Lake.

The data obtained here are used in connection with general reclamation projects under way in this locality. It is expected that storage reservoirs on the headwaters of this stream will make a large portion of the annual flow available during the summer months, and at the same time lower the water surface in Tule Lake, and thereby expose a considerable area of agricultural lands on the northern border of the lake.

The records obtained at this station are fairly reliable when the water surface in the lake is low. When the lake gage registers 9

feet or more, water is backed up the river to the gaging station, and even at lower lake stages winds blowing up the lake produce the same effect.

The year 1907 was a wet year and the water surface in the lake remained above the critical point for a good portion of the year. It was necessary, therefore, to use a method similar to the indirect method for shifting channels to eliminate this backwater effect. This was only partially successful, and discharges after May 31 have been omitted, as the records at the Olene station show closely the amount of water passing this point. It was deemed advisable, therefore, to abandon this station entirely February 28, 1909, in favor of the station at Olene. A comparison of the records at the two stations since May 20, 1907, will reveal somewhat the inaccuracy of the data at Merrill, as there is little or no difference between the flow at the two points as far as can be ascertained from surface conditions. The years 1905 and 1906, however, were dry years and the records at the Merrill were not greatly affected by backwater.

Discharge measurements of Lost River near Merrill, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
February 4	Hendricks and Sticksel	147	1,150	12.25	3,500
Do	do	148	1,230	12.75	3,950
February 7	J. Sticksel	228	3,540	16.90	7,430
February 8	do	226	3,260	16.50	7,240
February 9	do	218	2,920	15.00	5,520
Do	do	217	2,850	14.67	4,930
February 26	L. F. Hendricks	114	502	7.35	1,420
March 4	do	111	397	6.50	1,080
March 19	do	150	1,370	13.60	3,970
March 20	do	155	1,490	14.35	4,750
March 21	do	167	1,690	15.65	5,450
Do	do	169	1,740	15.90	5,550
March 22	do	170	1,780	16.05	5,470
March 23	do	162	1,620	15.10	4,980
Do	do	159	1,580	14.88	4,730
March 25	do	143	1,050	11.60	3,000
March 26	do	141	979	11.10	2,690
March 27	do	141	900	10.60	2,470
April 8	do	142	956	11.00	2,620
April 17	do	115	615	8.65	1,530
April 18	do	115	590	8.40	1,460
April 22	do	109	496	7.50	1,040
May 11	Stevens and Ellsworth	111	396	6.36	371
May 18	do	111	394	6.38	340
June 12	C. E. Ellsworth	110	367	6.15	189
June 26	do	110	343	6.10	228
July 2	do	110	349	6.05	255
1908.					
March 17	C. E. Ellsworth	114	492	7.27	1,280
April 9	do	105	250	5.05	200
May 4	Ellsworth and Kimble	105	236	4.82	139
August 21	H. Kimble	85	106	3.65	124
September 23	do	85	80	3.55	118
October 2	do	85	90	3.55	108
October 9	do	85	90	3.55	108
November 27	McGlashan and Kimble	89	91	3.48	117

Daily gage height, in feet, of Lost River near Merrill, Oreg., for 1907 and 1908.

[Clyde Bradley and Mrs. C. W. Lewis, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.48	5.7	7.75	11.55	6.7	6.1	6.1	5.5	5.0	4.7	4.7	4.6
2	4.2	7.9	7.4	12.45	6.6	6.2	6.1	5.4	5.0	4.7	4.7	4.6
3	4.15	8.7	6.9	12.1	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
4	4.0	12.4	6.7	11.5	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
5	3.9	15.8	6.6	11.1	6.4	6.3	5.9	5.4	5.0	4.7	4.7	4.6
6	3.8	18.1	6.75	11.55	6.5	6.4	5.8	5.4	5.0	4.7	4.7	4.6
7	3.8	18.25	7.1	10.52	6.5	6.2	5.8	5.4	5.0	4.7	4.7	4.6
8	3.75	16.85	7.1	10.95	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
9	3.7	14.55	7.0	12.1	6.5	6.2	5.8	5.4	5.0	4.7	4.7	4.6
10	3.65	11.55	7.65	12.25	6.3	6.3	5.8	5.3	5.0	4.7	4.6	4.6
11	3.6	9.35	7.85	10.95	6.4	6.45	5.8	5.3	5.0	4.7	4.6	4.6
12	3.6	8.35	7.5	10.1	6.2	6.3	5.8	5.3	5.0	4.7	4.6	4.6
13	3.5	7.9	6.9	9.72	6.3	6.3	5.7	5.3	5.0	4.7	4.6	4.6
14	3.5	7.4	6.75	9.5	6.4	6.0	5.7	5.3	5.0	4.7	4.6	4.6
15	3.55	7.1	6.55	9.15	6.4	6.0	5.8	5.2	5.0	4.7	4.6	4.6
16	3.6	6.8	6.35	8.82	6.45	6.15	5.7	5.2	5.0	4.7	4.6	4.6
17	3.5	6.55	6.4	8.62	6.4	6.2	5.7	5.2	5.0	4.7	4.6	4.6
18	3.5	6.45	7.05	8.38	6.4	6.2	5.7	5.2	5.0	4.7	4.6	4.6
19	3.5	6.5	9.9	8.22	6.3	6.45	5.6	5.2	4.9	4.7	4.6	4.6
20	3.45	6.7	13.75	8.0	6.3	6.15	5.7	5.2	4.9	4.7	4.6	4.6
21	3.45	6.65	15.8	7.85	6.2	6.0	5.6	5.1	4.85	4.7	4.6	4.6
22	3.45	6.7	16.0	7.65	6.25	6.1	5.7	5.1	4.85	4.7	4.6	4.7
23	3.45	6.8	14.95	7.45	6.3	6.1	5.6	5.1	4.85	4.7	4.6	4.7
24	3.45	8.35	13.3	7.3	6.3	6.1	5.6	5.1	4.8	4.7	4.6	4.7
25	3.45	8.6	11.85	7.2	6.3	6.1	5.6	5.1	4.8	4.7	4.6	4.7
26	3.45	7.7	11.05	7.1	6.3	6.1	5.5	5.1	4.8	4.7	4.6	4.7
27	3.4	7.65	10.6	6.95	6.2	6.1	5.5	5.1	4.8	4.7	4.6	5.7
28	3.4	8.05	10.25	6.85	6.2	6.0	5.6	5.1	4.8	4.7	4.6	5.75
29	3.45	.....	9.95	6.8	6.3	6.0	5.5	5.0	4.8	4.7	4.6	5.6
30	3.45	.....	9.8	6.7	6.25	6.1	5.5	5.0	4.8	4.7	4.6	5.4
31	3.65	.....	10.4	.....	6.2	.....	5.5	5.0	.....	4.7	.....	5.3
1908.												
1	5.2	5.1	5.0	5.3	5.0	4.6	4.2	3.9	3.6	3.6	3.5	3.5
2	5.1	5.0	5.0	5.3	4.9	4.4	4.2	3.8	3.6	3.6	3.5	3.5
3	5.0	5.0	5.0	5.2	4.7	4.4	4.2	3.8	3.6	3.5	3.5	3.5
4	5.0	5.0	5.0	5.2	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
5	5.0	5.0	5.0	5.2	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
6	5.0	5.0	5.0	5.1	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
7	4.9	5.0	5.0	5.0	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
8	4.9	5.0	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
9	4.9	5.0	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
10	4.9	5.0	5.0	5.0	4.65	4.5	4.1	3.8	3.6	3.5	3.5	3.5
11	4.9	4.8	5.0	5.0	4.6	4.5	4.0	3.8	3.6	3.5	3.5	3.5
12	4.9	4.9	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
13	4.9	4.9	5.0	5.0	4.7	4.5	4.1	3.7	3.6	3.5	3.5	3.5
14	4.8	4.9	5.0	5.0	4.7	4.5	4.2	3.7	3.6	3.5	3.5	3.5
15	4.8	4.9	5.1	5.0	4.7	4.5	3.9	3.7	3.6	3.6	3.5	3.5
16	4.9	4.9	5.8	5.1	4.7	4.5	4.0	3.7	3.6	3.5	3.5	3.5
17	5.45	4.9	7.4	5.1	4.8	4.4	4.0	3.7	3.6	3.6	3.5	3.5
18	6.0	4.9	7.7	5.1	5.0	4.3	4.0	3.7	3.6	3.5	3.5	3.5
19	6.2	4.9	7.5	5.0	4.9	4.3	4.0	3.7	3.6	3.5	3.5	3.5
20	6.1	4.9	6.9	5.0	4.9	4.4	3.9	3.7	3.6	3.5	3.5	3.5
21	5.9	4.9	6.5	5.0	4.7	4.3	3.9	3.7	3.6	3.5	3.5	3.5
22	5.7	4.9	6.2	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
23	5.7	4.9	6.0	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
24	5.7	4.9	6.0	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
25	5.6	4.9	5.8	4.8	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
26	5.5	4.9	5.6	4.8	4.7	4.3	3.9	3.7	3.6	3.5	3.5	3.5
27	5.3	4.9	5.5	4.7	4.7	4.2	3.9	3.7	3.6	3.5	3.5	3.5
28	5.2	4.9	5.5	4.8	4.8	4.2	3.8	3.6	3.6	3.5	3.5	3.5
29	5.2	5.2	5.5	4.8	4.7	4.3	3.8	3.6	3.6	3.5	3.5	3.5
30	5.1	.....	5.4	4.9	4.6	4.3	3.8	3.6	3.6	3.5	3.5	3.5
31	5.1	.....	5.3	.....	4.6	.....	3.9	3.6	.....	3.5	.....	3.5

Daily discharge, in second-feet, of Lost River near Merrill, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	444	824	1,490	2,800	600	16	180	1,180	856	1,560	300
2	360	1,560	1,380	3,260	540	17	150	1,100	856	1,450	330
3	345	1,870	1,180	3,080	495	18	150	1,060	1,050	1,380	330
4	300	3,680	1,110	2,770	480	19	150	1,080	2,080	1,310	300
5	270	6,300	1,080	2,570	435	20	135	1,140	4,030	1,210	300
6	240	9,000	1,110	2,800	450	21	135	1,130	5,620	1,140	270
7	240	9,200	1,210	2,290	450	22	135	1,140	5,780	1,080	270
8	225	7,250	1,210	2,500	420	23	135	1,180	4,870	984	300
9	210	5,160	1,140	3,080	420	24	135	1,140	3,740	920	300
10	195	3,210	1,340	3,160	360	25	135	1,830	2,970	872	285
11	180	2,140	1,410	2,470	360	26	135	1,490	2,570	824	270
12	180	1,740	1,280	2,120	300	27	120	1,470	2,330	760	240
13	150	1,560	1,080	1,950	330	28	120	1,620	2,160	696	240
14	150	1,380	984	1,830	360	29	135	.....	2,050	664	270
15	165	1,280	920	1,700	360	30	135	.....	1,990	600	255
						31	195	.....	2,250	.....	240

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Lost River near Merrill, Oreg., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	444	120	191	11,700	C.
February	9,200	824	2,600	144,000	B.
March	5,780	856	2,040	125,000	B.
April	3,260	600	1,790	107,000	B.
May	600	240	352	21,600	B.

NOTE.—Discharges have not been computed after May 31, 1907, as the records at Olene, which are much better than those at this station, show practically the same discharge as at Merrill.

TULE LAKE NEAR MERRILL, OREG.

This station was established May 17, 1904. It is located at J. F. Adams's ranch near the mouth of Lost River. The elevation of the zero of the gage has been taken as 4,048.21. When the station was established the gage was referenced to a bench mark on a juniper post near by. The bench mark at that time was 13.7 feet above the zero of the gage. On October 21, 1904, this elevation was verified. On May 11, 1907, the elevation of the same bench mark was found to be 12.87 feet above zero of the gage and was independently verified on June 11, 1907, and again on November 27, 1908. It appears, therefore, that some time between October, 1904, and May, 1907, gage was raised 0.83 foot. This was probably due to the action of ice in the lake, although nothing of this kind has been observed since that time. Just when it occurred it has been impossible to ascertain, and a graph of the heights has failed to reveal any critical points that would account for a sudden change. It is therefore likely that the gage was raised a little at a time during the winters of 1905–6 and 1906–7.

On account of this error the gage heights prior to May, 1907, should not be used for any refined studies.

Daily gage height, in feet, of Tule Lake near Merrill, Oreg., for 1907 and 1908.

[J. F. Adams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.35	7.4	9.05	10.5	11.35							
2											9.7	
3								10.5				
4			9.1									
5										9.75		
6							10.95					
7									10.05			9.6
8	7.3			10.9	11.3	11.3						
9											9.7	
10		8.6						10.4				
11												
12			9.3							9.75		
13							10.85					
14									9.95			
15												
16	7.3			11.15	11.3	11.3					9.65	9.55
17								10.3				
18												
19		8.8								9.75		
20							10.75					
21			9.9						9.8			9.6
22				11.3								
23	7.35				11.3						9.6	
24						11.15		10.25				
25												
26										9.75		
27							10.65					
28		9.05							9.75			9.65
29												9.65
30				11.35		11.0					9.6	9.7
31	7.4		10.5		11.3			10.15				9.7
1908.												
1	9.7	9.9						8.7				
2	9.7				9.9							
3	9.75									7.75		
4	9.8			10.1			9.2					
5									8.1			7.5
6						9.6						
7			9.95								7.6	
8		9.9						8.6				
9					9.85							
10										7.7		
11	9.8			10.05			9.15					
12									8.0			7.5
13						9.45						
14			9.95								7.6	
15		9.9						8.45				
16					9.8							
17										7.65		
18	9.85			10.0			9.0					
19									7.85			7.4
20						9.35						
21			10.0								7.5	
22		9.9						8.2				
23					9.75							
24										7.65		
25	9.9			9.95			8.9					
26									7.8			7.35
27						9.25						7.35
28			10.1								7.5	7.35
29		9.95						8.1				7.35
30					9.7							7.35
31										7.6		7.35

MILLER CREEK NEAR LORELLA, OREG.

This station was established August 10, 1904. It is located at the lower end of Horsefly Valley, which is intended for use as a storage reservoir by the United States Reclamation Service in its general work in this locality. The gaging station is located in sec. 12, T. 39 S., R. 13 E., 9 miles northeast of Lorella.

During the winter months the river freezes over completely, and the data obtained at such periods are not reliable. As the total annual flow, however, is the important feature, a large error during such periods is admissible without affecting the desired results.

The conditions at the station during the open season are favorable for good results. A riffle controls the flow just below the station. The datum of the gage has not been altered since it was installed, and during a large portion of the time gage heights have been obtained by an automatic Friez gage.

The surface flow entirely disappears during the summer months.

Discharge measurements of Miller Creek near Lorella, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 8	L. F. Hendricks	138	166	8.02	505
Do	do	135	125	7.70	332
April 13	do	136	170	7.95	466
April 25	do	80	47	7.00	80
May 14	Stevens and Ellsworth	83	43	6.75	57
June 6	C. E. Ellsworth	25	16	6.20	5.8
June 21	do	45	23	6.41	16
1908.					
February 22	C. E. Ellsworth	29	20	6.32	12
March 19	do	125	111	7.56	298
April 7	do	50	29	6.60	35
May 1	Ellsworth and Kimble	25	14	6.10	2.0
November 24	Kimble and McGlashan	27	11	6.09	1.5

Daily gage height, in feet, of Miller Creek near Lorella, Oreg., for 1907 and 1908.

[O. R. Stewart, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.45	7.70	7.30		6.77	6.26					6.18	
2	6.20	8.90	7.30		6.73	6.25					6.20	
3	6.10	11.55	7.25		6.70	6.24					6.20	
4	6.10	13.00	7.20		6.70	6.20					6.20	
5	6.10	14.00	7.35		6.68	6.18					6.19	
6	6.10	12.00	7.40	8.10	6.65	6.22	6.00				6.19	
7	6.10	10.00	7.40	9.50	6.65						6.18	6.20
8	6.10	7.70	7.85		6.65	6.35						
9	6.10	7.85	7.90		6.63						6.10	
10	6.10	7.65	7.55		6.58						6.10	
11	6.10	7.55	7.50		6.70						6.10	
12	6.10	7.45	7.30		6.78						6.10	
13	6.10	7.30	7.35	8.00	6.81						6.10	
14	6.10	7.25	7.20		6.75						6.10	6.10
15	6.10	7.20	7.20		6.66	7.00					6.10	

Daily gage height, in feet, of Miller Creek near Lorella, Oreg., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907												
16	6.10	7.20	7.20		6.58						6.10	
17	6.10	7.35	8.00		6.50						6.12	
18	6.10	7.50	9.80		6.50						6.11	
19	6.10	7.40	10.15		6.58						6.11	
20	6.10	7.35	9.80	7.10	6.62						6.11	
21	6.10	7.30	9.40	7.10	6.65						6.11	6.40
22	6.10	8.00	9.00	7.10	6.75	6.30					6.16	
23	6.20	7.80	8.70	7.05	6.70						6.20	8.00
24	6.20	7.40	8.30	7.00								8.00
25	6.30	7.80	7.90	7.00	6.70							7.60
26	6.30	7.85	7.60	6.95	6.65		5.70			6.12		7.15
27	6.30	7.70	7.75	6.90	6.57					6.15		7.15
28	6.30	7.40	7.65	6.88	6.49					6.20		7.05
29	6.65		7.95	6.85	6.42	6.10				6.17		
30	7.20		8.50	6.80	6.35					6.20	6.10	
31	7.95		8.40		6.29					6.20		
1908.												
1		6.20		6.70	6.10							6.01
2				6.70	6.07							
3				6.60	6.05	6.00						
4	6.50			6.50	6.04							
5				6.50	6.05							6.02
6				6.51	6.09							
7			6.70	6.55	6.09	5.90						
8		6.20		6.54	6.05							
9		6.16		6.50								
10		6.00		6.44	6.21							
11	6.40	6.15		6.40	6.22							
12		6.18		6.40	6.22							
13		6.20		6.40	6.23							
14			7.60	6.38	6.18	5.90						
15		6.40		6.36	6.12							
16		6.35		6.35	5.90							
17		6.30		6.50	6.50							
18	7.30	6.30		6.40								
19	7.30	6.30	7.60	6.39								
20	7.30	6.30		6.32								
21	7.32		6.90	6.28								
22	7.34	6.32		6.26								
23	7.37			6.24								
24				6.24	6.60						6.09	
25	7.40			6.23								
26				6.22								
27				6.22								
28			6.70	6.15								
29		6.50		6.10								
30												
31			6.70									

NOTE.—The creek was dry from about July 11 to October 25, 1907, and from July 1 to November 10, 1908. Creek frozen at gage December 15 to 28, 1907, and November 20 to December 31, 1908. It does not freeze except in very cold weather at low stages.

Rating table for Miller Creek near Lorella, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.90	0	7.20	138	8.50	775	10.60	2,490
6.00	0.3	7.30	170	8.60	835	10.80	2,690
6.10	1.7	7.40	206	8.70	900	11.00	2,900
6.20	5.0	7.50	246	8.80	965	11.20	3,120
6.30	10.0	7.60	290	8.90	1,035	11.40	3,360
6.40	16.6	7.70	337	9.00	1,110	11.60	3,600
6.50	25	7.80	387	9.20	1,260	11.80	3,840
6.60	35	7.90	437	9.40	1,415	12.00	4,080
6.70	46	8.00	490	9.60	1,575	13.00	5,310
6.80	59	8.10	545	9.80	1,745	14.00	6,730
6.90	73	8.20	600	10.00	1,920		
7.00	90	8.30	655	10.20	2,100		
7.10	112	8.40	715	10.40	2,290		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1908 and is well defined.

Monthly discharge of Miller Creek near Lorella, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	464	1.7	24.3	1,490	B.
February	6,730	138	1,020	56,600	A.
March	2,060	138	543	33,400	A.
April	1,500	59	448	26,700	B.
May	60	9.5	39.0	2,400	A.
June	90	1.5	26.6	1,580	B.
July	1.3	0	.17	10.4	C.
August	0	0	0	0	
September	0	0	0	0	
October	5.0	0	.80	49.2	C.
November	5.0	1.7	3.02	180	C.
December	490	1.7	71.9	4,420	B.
The year	6,730	0	181	127,000	
1908.					
January	206	16.6	95.4	5,870	B.
February	25	.3	10.1	581	C.
March	290	28	123	7,560	B.
April	46	1.7	17.5	1,040	B.
May	35	0	13.9	855	B.
June	7	0	.39	23	C.
July	0	0	0	0	
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	.....	0	.48	29	D.
December	.....	.....	.56	34	D.
The year	290	0	21.8	16,000	

NOTE.—Discharges for November and December estimated from comparison with Lost River at Clean Lake.

EVAPORATION STATION AT KENO, OREG.

This station was established August 1, 1904, to determine the evaporation from a water surface, and has been maintained continuously since that time. During the winter months, when ice interferes and when heavy upstream winds are blowing, it is impossible to obtain observations. The records are therefore somewhat irregular.

Evaporation is measured by means of a galvanized-iron pan, 3 feet square by 18 inches deep, floated in the river to within about 2 inches of the top of the pan. In the center of the pan is a needle point, to which the water surface can be adjusted with nicety. The observer has a galvanized-iron cup which holds a sufficient quantity of water to raise the water in the pan one-tenth of an inch. At each visit of the observer the water surface is adjusted to the point. At the time of the next observation, if no rain has occurred, it is only necessary to count the number of cupfuls required to fill the pan to the point again. This gives the evaporation in inches. A rain gage is also maintained in connection with the pan, and corrections are made if any rain has occurred between observations.

This method will determine directly the evaporation from the pan. The only source of error involved lies in the possibility that evaporation from this pan is not representative of the evaporation from a larger area. The method of course does not determine the rate of evaporation, but as the total quantity during a month or in the year is, as a rule, all that is required, it is believed that the errors are compensating and that the data are sufficiently accurate for all practical purposes.

Evaporation, in inches, from water surface at Keno, Oreg.

[T. A. Grubb, observer.]

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907	.....	.....	.....	.....	[a] 1.07	3.29	4.70	6.30	4.05	2.42	1.17	[b] 0.90
1908	.....	0.83	1.20	2.81	3.38	5.60	8.01	7.40	4.62	2.17	.89	[c] .11

[a] May 23 to 31 only.
[b] Partial record, pan frozen from December 12, 1907. to February 10,1908.
[c] Partial record, pan frozen at intervals.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements have been made on streams in California during 1907 and 1908. They are arranged in the same order of drainage basins as the regular stations:

THE GREAT BASIN IN CALIFORNIA.

Miscellaneous discharge measurements in Mono Lake drainage basin, 1907.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 22	Rush Creek	Mono Lake	Road crossing near lake	.....	430
Do	Levining Creek	do	do	.....	248

Miscellaneous discharge measurements in Owens River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
1907.				*Feet.*	*Sec.-ft.*
July 24	Owens River	Owens Lake	Thompson ranch, Long Valley.		217
1908.					
May 18	do	do	Citrus, Cal		44
May 26	do	do	do		46
June 3	do	do	do		40
May 18	do	do	Alabama Hills		50
May 26	do	do	do		51
June 3	do	do	do		45
May 18	do	do	Mount Whitney bridge near Lone Pine, Cal.		53
May 27	do	do	do		54
June 3	do	do	do		49
July 23	do	do	do	4.0	146
August 7	do	do	do	5.7	436
August 9	do	do	do	5.95	483
August 18	do	do	do	4.45	220
September 10	do	do	do	3.52	80
September 25	do	do	do	4.26	180
October 18	do	do	do	4.75	255
October 28	do	do	do	5.3	355
November 21	do	do	do	5.5	381
1907.					
July 18	Hilton Creek	Owens River	Long Valley		44
Do	Convict Creek	do	do		188
July 19	Hot Creek	do	do		120
July 22	Magee Creek	do	do		141
July 23	Crooked Creek	do	do		15
March 12	Pine Creek	do	Mouth of canyon, Round Valley.		25
January 24	Horton Creek	do	Round Valley-Bishop road crossing.		11
March 11	do	do	do		2
1908.					
June 19	do	do	Round Valley-Bishop road crossing.		6.6
July 16	do	do	do		12
August 3	do	do	do		20
August 25	do	do	do		6.2
September 16	do	do	do		8.6
October 7	do	do	do		5.3
October 22	do	do	do		13
November 6	do	do	do		12
November 25	do	do	do		13
June 19	Magee Creek	do	Road crossing Round Valley		2
July 16	do	do	do		3.7
1907.					
March 8	Coyote Creek	Bishop Creek	At Butler ranch, ½ mile above junction with Bishop Creek.		0.3
April 29	do	do	do		16
February 8	Fish Springs	Owens River	At outlet of springs		25
January 27	Taboose Creek	do	Upper road crossing, 2 miles above regular gaging station.		3.4
1908.					
April 8	Seeley Springs	do	Outlet springs near Charlies Butte.		1.3
May 22	do	do	do		1.4
June 2	do	do	do		1.1
June 12	do	do	do		1.3
July 29	do	do	do		1.8
November 25	do	do	do		1.3
1907.					
February 19	Division Creek	do	Mouth of canyon, 3½ miles above regular gaging station.		13
Do	Black Rock Springs	do	Outlet springs near Independence.		27
1908.					
March 12	do	do	Outlet spings near Independence.		24

Miscellaneous discharge measurements in Owens River drainage basin, 1907 and 1908—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
1907.				*Feet.*	*Sec.-ft.*
May 4	Symmes Creek	Owens River	2 miles west of county road near Independence.		2
May 23	do	do	do		9.8
June 15	do	do	do		13
July 10	do	do	do		15
August 14	do	do	do		1.8
August 30	do	do	do		1.1
1908.					
May 9	do	do	do		2.1
June 23	do	do	do		2.3
1907.					
May 21	Carroll Creek	Owens Lake	Road crossing on Lone Pine-Olancha road.		5.4
June 4	do	do	do		7.5
June 25	do	do	do		4.2
July 8	do	do	do		2
1908.					
May 28	do	do	do		1.4
1907.					
January 31	Cottonwood Creek	do	Below junction of South Fork.		13
September 28	do	do	At intake Los Angeles Aqueduct pipe line.		13
November 8	do	do	do		25
November 23	do	do	do		17

Discharge measurements of canals in Owens River drainage basin, 1907 and 1908.

Date.	Canal.	Diversion from—	Locality.	Discharge.
1907.				*Sec.-ft.*
April 13	Williams	Pine Creek	Williams ranch	5.0
April 30	Owens River	Owens River	Sec. 27, T. 6 S., R. 32 E., Mount Diablo meridian.	42
Do	Bishop Creek	do	Below waste gate, 3 miles above Bishop.	97
Do	Farmers	do	House of Robt. Love, 3 miles above Bishop.	29
May 13	McNally	do	Intake 3¾ miles north of Bishop, Cal.	61
May 1	Geo. Collins	do	Bridge 3 miles east of Bishop, Cal.	9.9
February 9	Big Pine	do	Near Center School	31
May 1	do	do	do	38
Do	Rawson	do	At county bridge 2½ miles east of Bishop.	36
May 11	Dell	do	In flume 3 miles below intake	26
January 22	Blake and Miller	Big Pine Creek	½ mile below head gate	50
May 16	do	do	do	12.2
1908.				
May 16	Stevens	Owens River	Citrus, Cal.	9.7
May 26	do	do	do	9.7
June 3	do	do	do	11
May 16	East Side	do	do	9.1
May 26	do	do	do	12
June 3	do	do	do	15

Miscellaneous discharge measurements of streams that discharge into the Mohave Desert, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
October 13	Little Rock Creek	Mohave Desert	3 miles above Little Rock, in canyon.	1.1
October 14	Rock Creek	do	1½ miles above Shoemaker, in canyon.	6.5
Do	do	do	Road crossing below junction of Pallett Creek.	9.4
Do	Pallett Creek	Rock Creek	At road crossing near schoolhouse, above junction with Rock Creek.	1.8

NOTE.—The above measurements include all diverted water and represent total flow of streams. These creeks lie east of Palmdale, Los Angeles County, Cal.

SOUTH PACIFIC OCEAN DRAINAGE AREA.

Miscellaneous discharge measurements in San Luis Rey River drainage basin, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
May 21	San Luis Rey River.	South Pacific Ocean.	At proposed dam site, Warner's ranch in sec. 10, T. 11 S., R. 2 E., San Bernardino meridian.	5.2

Miscellaneous discharge measurements in Santa Margarita River drainage basin, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
July 12	Temecula River	Santa Margarita River.	Old gaging station near Temecula, Cal.	[a] 2.6

[a] Gage height, 6.12 feet.

Miscellaneous discharge measurements in Santa Ana River drainage basin, 1907.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
September 18	Mill Creek	Santa Ana River	Below power plant No. 1, Edison Co.	[a] 33
September 19	Plunge Creek	do	Mouth of canyon, East Highland	[a] 3
Do	City Creek	do	Mouth of canyon, Highland	[a] 4.6
September 17	East Twin Creek	do	Mouth of canyon, near Arrowhead Hotel.	[a] 2.3
Do	Waterman Canyon, or West Twin Creek.	do	do	[a] 2.0
June 26	Mill Creek	do	Forest Home, above upper diversion, Edison Electric Co.	[a] 61
August 23	Chino Creek	do	Wagon bridge, Rincon road crossing	2.6
Do	Santa Ana River	Main stream	Wagon bridge, Rincon, Cal.	63

[a] Includes all diversions and represents total flow of creek.

Miscellaneous discharge measurements in Los Angeles River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
1907.				*Sec.-ft.*
March 5	Los Angeles River.	Main stream	Seventh Street Bridge, Los Angeles, Cal.	3,200
April 17	Arroyo Seco	Los Angeles River.	Mouth of canyon, below junction Millard Canyon.	[a] 40
May 14	do	do	do	[a] 18
1908.				
April 17	do	do	do	[a] 5
July 14	do	do	1 mile above junction Millard Canyon	[a] 3

[a] Includes all diverted water and represents total flow of stream.

SAN FRANCISCO BAY DRAINAGE AREA.

Miscellaneous discharge measurements in Sacramento River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Oct. 21, 1907 [a]	Old Cow Creek	Cow Creek	Sec. 12, T. 32 N., R. 1 W., Mount Diablo meridian.	35.8
June 24, 1907 [a]	South Fork Cow Creek.	do	Sec. 32, T. 32 N., R. 1 W., Mount Diablo meridian.	88.8
Oct. 21, 1907 [a]	do	do	do	34.6
June 12, 1907	Stony Creek	Sacramento River	Near Rockville, above junction with Little Stony Creek.	157
June 3, 1908	do	do	do	106
June 9, 1908	do	do	do	82
Do	do	do	At Rockville	88
June 10, 1908	do	do	do	99
June 12, 1907	Little Stony Creek.	Stony Creek	Above Rockville and above junction with Stony Creek.	22
June 3, 1908	do	do	do	8.5
June 9, 1908	do	do	do	8.5
June 12, 1907	Briscoe Creek	do	1 mile above Elk Creek post-office	12
June 3, 1908	do	do	do	4.0
June 10, 1908	do	do	do	3.1
June 12, 1907	Elk Creek	do	Near Elk Creek post-office and above junction with Stony Creek.	7.7
June 3, 1908	do	do	do	1.8
June 10, 1908	do	do	do	.7
June 12, 1907	Salt Creek	do	2 miles below Elk Creek	2.4
June 3, 1908	do	do	do	.91
June 10, 1908	do	do	do	.25
June 12, 1907	Grindstone Creek	do	½ mile above junction with Stony Creek.	94
June 3, 1908	do	do	do	78
June 10, 1908	do	do	do	64

[a] These measurements were furnished by R. E. Johnson, C. E.

KLAMATH RIVER DRAINAGE BASIN.

Miscellaneous measurements in drainage basin of Klamath River proper, 1907.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
July 1, 1907	Klamath River	North Pacific Ocean	Words Bridge, sec. 28–29, T. 48 N., R. 4 W., Cal.	4,000
June 30, 1907	Fall Creek	Klamath River	0.8 mile above mouth, sec. 30, T. 48 N., R. 4 W., Cal.	59
July 3, 1907	Jenny Creek	do	Grieve's ranch, sec. 22 or 27, T. 40 S., R. 4 E., Oreg.	26
June 26, 1907	Shasta River	do	4 miles northeast Yreka, Cal., sec. 1, T. 45 N., R. 7 W.	250

Miscellaneous measurements in Upper Klamath Lake drainage basin, 1907 and 1908.

Date.	Stream—	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 6, 1907	Wood River	Upper Klamath Lake.	Fort Klamath, Oreg		295
Aug. 24, 1907	do	do	do		391
Sept. 16, 1907	do	do	do	8.40	338
Oct. 6, 1907	do	do	do	8.50	330
Mar. 3, 1908	do	do	do	8.50	318
Apr. 28, 1908	do	do	do	8.55	330
May 16, 1908	do	do	do	8.40	314
July 16, 1908	do	do	do	8.50	357
Sept. 26, 1908	do	do	do	8.30	279
Oct. 18, 1908	do	do	do	8.30	306
Aug. 7, 1907	Anna Creek	do	Sec. 16, T. 33 S., R. 7 E		62
May 15, 1908	do	do	do		62
Sept. 20, 1908	do	do	4 miles below Arants		45
Do	Anna Creek Spring.	Anna River	Arants		2.7
Aug. 6, 1907	Fort Creek	Wood River	Sec. 27, T. 33 S., R. 6 E		94
Apr. 28, 1908	do	do	2 miles southeast of Fort Klamath.	−2.31	115
July 16, 1908	do	do	do	−3.40	95
Sept 26, 1908	do	do	do	1.10	94
Oct. 18, 1908	do	do	do	1.10	95
Aug. 7, 1907	Crooked River	do	Klamath Agency, Oreg		41
Apr. 28, 1908	do	do	do	−a2.50	52
May 15, 1908	do	do	do	−a1.40	52
July 16, 1908	do	do	do	−a2.8	47
Sept. 25, 1908	do	do	do	.70	52
Oct. 17, 1908	do	do	do	.95	55
Aug. 7, 1907	Tecumseh Creek	Crooked River	½ mile north of Klamath Agency, Oreg.		20
Apr. 28, 1908	do	do	do		23
May 15, 1908	do	do	do		25
July 16, 1908	do	do	do		28
Sept. 25, 1908	do	do	do		29
Oct. 17, 1908	do	do	do		30
Aug. 7, 1907	Beetles Rest Springs.	Tecumseh Creek	do		25
Mar. 23, 1908	do	do	do		26
Apr. 27, 1908	do	do	do		25
Aug. 6, 1907	Sevenmile Creek	Upper Klamath Lake.	Sec. 28, T. 33 S., R. 6 E		94
Oct. 19, 1908	do	do	do		57
Aug. 6, 1907	Crane Creek	do	Sec. 29, T. 33 S., R. 6 E		11
Aug. 5, 1907	Threemile Creek	do	Sec. 11, T. 34 S., R. 6 E		b 2
Do	Cherry Creek	do	Sec. 23, T. 34 S., R. 6 E		19
Aug. 3, 1907	Jones Creek	do	Sec. 9, T. 36 S., R. 6 E		7.7
Do	Moss Creek	do	Sec. 32, T. 36 S., R. 7 E		b 1.0
Do	Rock Creek	do	Sec. 9, T. 37 S., R. 7 E		6.8
Aug. 4, 1907	Fourmile Creek	do	Sec. 4, T. 36 S., R. 5 E		2.3
Aug. 7, 1907	Williamson River	do	Chillaquin Bridge, above mouth of Sprague River.		513
Oct. 7, 1907	do	do	do		507
Oct. 20, 1908	do	do	do		692
Apr. 29, 1908	do	do	Below mouth of Sprague River.	3.88	2,000
Aug. 8, 1907	do	do	4 miles above mouth		985
Oct. 5, 1907	do	do	do	2.20	960
Sept. 27, 1908	Spring River	Williamson River	Strattons Camp	1.25	473
Oct. 7, 1907	Sprague River	do	5 miles below Yainax Agency, Oreg.	13.55	290
Oct. 21, 1908	do	do	do	13.5	315
May 21, 1908	Main Klamath project canal.	Upper Klamath Lake.	Klamath Falls, Oreg		66
Nov. 11, 1908	Moore Bros. power flume.	Link River	do		65
Nov. 21, 1908	do	do	do		65

a Below top of bridge plank marked with cross. b Estimated.

Miscellaneous measurements in lower Klamath Lake drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 20, 1907	Willow Creek	Lower Klamath Lake.	Brownell, Cal.		2.8
May 6, 1908	do	do	do		10
July 3, 1908	do	do	do		15
Nov. 8, 1908	do	do	do		13
Nov. 28, 1908	Fords Springs	Willow Creek	do		2.0
May 7, 1908	Sheepy Creek	Lower Klamath Lake.	Near mouth, Dorris, Cal.		32
July 4, 1908	do	do	do		34
Nov. 9, 1908	do	do	do		40
Aug. 20, 1907	Cottonwood Creek	do	Sec. 14, T. 47 N., R. 8 E., Cal.	1.85	13
May 6, 1908	do	do	J. F. ranch, Brownell, Cal.		[a] 16
July 3, 1908	do	do	do		[a] 21
Nov. 8, 1908	do	do	do		[a] 14
Aug. 20, 1907	Slow Creek	do	Sec. 11, T. 47 N., R. 1 E.		[b] 2.0
May 6, 1908	Dorris Creek	do	Dorris, Cal		8.0
July 2, 1908	do	do	do		7.6
Nov. 8, 1908	do	do	do		6.5

[a] Includes flow in two irrigating ditches.
[b] Estimated.

Miscellaneous measurements in Tule Lake drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Mar. 17, 1908	Lost River	Tule Lake	10 miles above Merrill		1,300
May 13, 1907	East Fork of Lost River.	Lost River	Sec. 3, T. 48 N., R. 7 E., Cal.		2.0
May 16, 1908	Olene Springs	do	Olene		2.9
Apr. 13, 1908	Tule Lake outlet		Scorpion Point, near Cornell, Cal.		[a] 14.4
Apr. 23, 1908	do		do		[a] 14.4
May 3, 1908	do		do		[a] 16.4
May 12, 1908	do		do		[a] 14.2
June 10, 1908	do		do		[a] 11.9
June 26, 1908	do		do		[a] 12.8
July 10, 1908	do		do		[a] 14.4
Dec. 7, 1908	do		do		[a] 33
Dec. 23, 1908	do		do		[a] 29

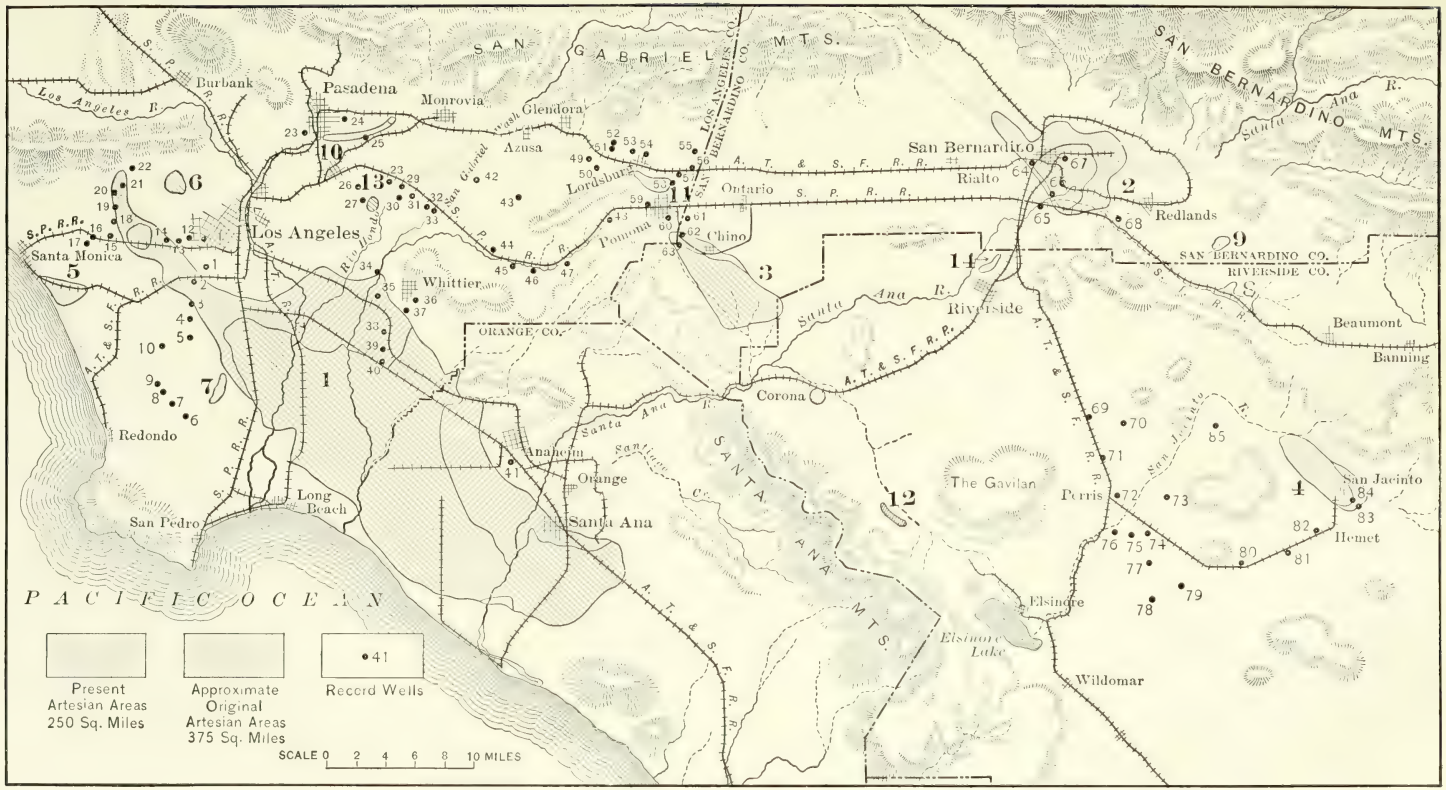
[a] During 1908 the Reclamation Service excavated two holes on the south shore of the lake, about 20 feet from the edge of the water. These holes were connected with the lake and these measurements show the amount of water flowing out through the lava beds.

FLUCTUATIONS IN GROUND-WATER LEVELS IN THE VALLEY OF SOUTHERN CALIFORNIA.

By W. C. Mendenhall.

Water-Supply Paper 213 contains a chapter on the variations of water level in wells in southern California. In this chapter were assembled the results of measurements made during 1904, 1905, and 1906, as an incident in the study of the valuable ground waters of this part of the State, the use made of them, and the effects of this use on the permanence of the supply.

The chief purpose of these observations was to supply data for use in specific studies of conditions controlling the occurrence and distribution of the ground waters in definite areas in southern California, and the facts assembled have been used and will continue to be used



MAP OF VALLEY OF SOUTHERN CALIFORNIA, SHOWING LOCATION OF WELLS SELECTED TO SHOW GROUND-WATER CONDITIONS.

in generalized form for this original purpose. It has been thought best, however, to publish the details of such measurements in these annual progress reports, in order that they may thus be made available, at the earliest date possible, for engineers and for the courts in the suits constantly before them on questions involving ground as well as surface waters.

The measurements assembled here form a continuation of those published in Water-Supply Paper 213. They were made at irregular intervals during 1907 and 1908 on the same wells that were measured during the earlier period, except a few that had become inaccessible.

The rainfall in the winters of 1904–5, 1906–7, and 1907–8 was well above the average for southern California. In these periods, therefore, the ground-water levels should have shown a marked recovery from the low stages reached at the close of the dry decade beginning with 1893. During the first two of these seasons the recovery was disappointing, the excess rainfall apparently being nearly all required to saturate the thoroughly dry surface zone in the drainage basins, or else, because of a distribution of the storms that was not most advantageous, a large part of the excess that should have served to restore the underground reservoirs escaped to the sea in floods. But the cumulative effect of the continued wet winters became distinctly manifest during the season of 1906–7 in many of the important wells and was observed also during the succeeding winter. The improvement of course has not been uniform, because conditions have not been uniform, and, more important still, it has not been universal. A few unfavorably situated wells have exhibited practically continuous slow declines throughout this four-year period of favorable conditions. On the other hand, in some important sections the recovery has been very striking.

Because of the insufficiency of funds and the extension of ground-water studies over other fields, it has not been possible to make as many measurements in this region during 1907 and 1908 as during the earlier years, hence the details of the rise and fall of the ground-water plane are not shown, but only its general tendencies. The results, however, although insufficient to serve as a basis for a close study of the character of the fluctuations and their immediate relation to the various factors of direct control, such as floods, nevertheless indicate to each of the communities in which records wells have been selected, the essential facts of improvement or deterioration in conditions.

Plate VII shows the location of the wells whose records are given in the following pages. The numbers correspond to those on the map.

Variations of water level in wells in southern California.

1. R. Kidson, three-fourths mile northeast of Slauson.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 5	46	3
May 1	45	4
August 21	46	2
December 24	45	9
1908.		
April 29	46	1
June 26	46	4
October 20	47	5

2. Chinese Gardeners, one-half mile southwest of Slauson.

1907.		
February 5	23	8
May 1	22	½
August 21	24	10
December 24	23	1½
1908.		
April 29	23	3
June 26	25	1
October 20	24	10
December 17	24	8

3. Eliza Connelly, 1½ miles north of Sunnyside.

1907.		
February 5	22	7
May 1	22	7
August 21	23	10
1908.		
April 29	23	5
June 26	24	6
October 20	24	8
December 17	24	4

4. Mr. Till, 2½ miles south of Slauson.

1907.		
February 5	30	
May 1	29	4½
August 21	30	10
December 24	31	2
1908.		
April 29	31	2
June 26	31	9
October 20	32	3
December 17	32	3

5. J. P. Brockley, three-fourths mile north of Howard Summit.

1907.		
February 5	86	10
May 1	85	3
August 21	85	1
December 24	84	9
1908.		
April 29	84	8
June 26	87	
October 20	86	
December 17	86	10

6. F. H. Carrell, 1¼ miles southwest of Gardena.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 5	26	1½
May 1	27	2
August 21	30	5½
December 24	26	10½
1908.		
April 29	29	½
June 26	30	6
October 20	28	8
December 17	27	4

7. A. B. Caldwell, one-fourth mile south of Moneta.

1907.		
February 5	24	4½
May 1	27	7
December 24	24	11½
1908.		
April 29	32	7
June 26	33	6
October 20	27	6
December 17	25	7

8. H. J. Harris, one-half mile north of Moneta.

1907.		
February 5	25	6½
May 1	29	1
August 21	34	
December 24	34	8
1908.		
April 29	33	
June 26	34	7
October 20	33	6
December 17	27	3

9. Stanley Bates, three-fourths mile northwest of Moneta.

1907.		
February 5	35	6
May 1	36	8
August 21	40	2
December 24	36	6
1908.		
April 29	40	1
June 26	43	½
October 20	38	11½
December 17	39	6

10. Post and Lockhart, 2 miles west of Howard Summit.

1907.		
May 1	38	4½
August 21	30	10½
December 24	30	9
1908.		
April 29	Pumping.	
June 26	37	8
October 20	Pumping.	
December 17	36	9

Variations of water level in wells in southern California—Continued.

11. William Bayley, Chester place, Los Angeles.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 6	71	½
May 2	70	6
August 22	70	1
December 23	70	2½
1908.		
April 30	70	6
June 27	70	10
October 21	71	7
December 18	71	11

12. Tony Bright, West Jefferson street, Los Angeles.

1907.		
May 2	49	3½
August 22	49	8½

13. Mrs. Showers, West Jefferson street, Los Angeles.

1907.		
February 6	34	2½
May 2	33	6
August 22	34	9

14. Artesian Land and Water Company, three-fourths mile north of Cienaga station.

1907.		
February 6	7	4½
May 2	7	4
August 22	8	6½
December 23	9	7
1908.		
April 30	7	
June 27	7	11
October 21	9	
December 18	8	6

15. Los Angeles County, Ivy station.

1907.		
February 6	11	7½
May 2	11	2½
August 22	12	5
December 23	12	10
1908.		
April 30	12	4
June 27	12	8
October 21	13	4
December 18	13	2

16. M. P. Kane, Palms.

1907.		
February 6	49	6½
May 2	50	8
August 22	50	2
December 23	50	3

17. F. P. Bojorquez, Palms.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 6	44	1
May 2	46	½
December 23	44	7½
1908.		
April 30	46	2
June 27	48	3
October 21	45	5
December 18	45	7

18. Jose Sesma, 1 mile north of Ivy station.

1907.		
February 6	44	5
May 2	44	2½
August 22	44	7½
1908.		
April 30	44	9
June 27	44	10
October 21	44	11
December 18	45	

19. J. H. Whitworth, 2 miles south of Sherman.

1907.		
February 6	6	11
May 2	7	
August 22	7	5½
1908.		
April 30	5	5
June 27	7	6
October 21	6	6
December 18	6	2

20. Hammel Decker, 1 mile south of Sherman.

1907.		
February 6	11	2
May 2	10	½
August 22	11	½
December 23	10	11
1908.		
April 30	10	8
June 27	11	2
October 21	12	
December 18	29	1

21. William Niles, three-fourths mile south of Sherman.

1907.		
February 6	5	3
May 2	6	5½
August 22	7	4
December 23	7	½
1908.		
April 30	3	2
June 27	3	11
October 21	3	2
December 18	2	6

Variations of water level in wells in southern California—Continued.

22. Los Angeles County, 1 mile east of Sherman.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
May 2	85	6½
August 22	83	1½
December 23	81	10
1908.		
April 30	86	2
June 27	89	7
October 21	95	
December 18	Dry.	

23. Mr. Hurlbut, Pasadena.

1907.		
February 8	76	3½
May 3	74	10½
August 24	74	9
1908.		
April 28	72	2½
June 30	73	2
October 12	75	2
December 19	75	2

24. L. V. Harkness, 1½ miles southeast of Pasadena.

1907.		
February 8	122	5
May 3	120	11
August 24	120	4
December 28	118	1
1908.		
April 28	117	
June 30	119	1
October 12	118	6
December 19	118	1

25. Titus ranch, Sunny Slope station.

1907.		
February 8	11	4½
May 3	10	8
August 24	15	

26. John McClain estate, 1 mile south of San Gabriel.

1907.		
February 8	70	6
May 3	68	11
August 24	69	4
December 28	66	9½

27. F. E. Wilson, 2 miles south of San Gabriel.

1907.		
February 8	21	9
May 3	18	9
August 24	18	3
December 28	19	6
1908.		
April 28	18	6
June 30	19	3
October 12	19	3
December 19	19	7

28. G. B. Renfro, three-fourths mile southwest of Savannah.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 8	16	11
May 3	15	9½
August 24	16	6
December 28	16	2
1908.		
April 28	15	6
June 30	15	8
October 12	16	
December 19	15	5

29. J. A. Law, one-half mile west of El Monte.

1907.		
February 8	10	1½
May 3	8	5½
August 24	10	
December 28	9	6
1908.		
April 28	8	7
June 30	10	3
October 12	10	3
December 19	9	4

30. M. Ritter, El Monte.

1907.		
February 8	13	7
May 3	10	
August 24	9	9
December 28	10	8
1908.		
April 28	10	
June 30	10	2
October 12	12	5
December 19	12	10

31. Mrs. McClure, three-fourths mile south of El Monte.

1907.		
February 8	8	1
May 3	7	[illegible]
August 24	8	6½
December 28	8	3
1908.		
April 28	8	
June 30	9	2
October 12	9	10
December 19	9	4

32. T. D. Andrews, 1½ miles southeast of El Monte.

1907.		
February 8	10	2½
May 3	7	8½
August 24	9	9
December 28	9	10½
1908.		
April 28	9	6
June 30	10	9
October 12	12	2
December 19	11	10

Variations of water level in wells in southern California—Continued.

33. Jackson Frees, 2 miles southeast of El Monte.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 8	15	6
May 3	13	1½
August 24	15	9½
December 28	16	1½
1908.		
April 28	15	5
June 30	17	1
October 12	18	4
December 19	17	9

34. E. Gurado, 3 miles southwest of Whittier.

1907.		
February 9	8	3½
May 4	8	1
August 22	8	10
December 27	8	9
1908.		
April 27	8	10
June 29	9	
October 19	9	3
December 24	8	11

35. Mrs. Mary Pheland, 2 miles southwest of Whittier.

1907.		
February 9	11	2
May 4	11	1
August 22	11	4
December 27	11	5½
1908.		
April 27	10	11
June 29	11	5
October 19	Well closed.	
December 24	Well closed.	

36. H. C. Baldwin, one-half mile southeast of Whittier.

1907.		
February 9	127	10½
May 4	127	4
August 22	127	7½

37. C. A. Landreth, 1 mile south of Whittier.

1907.		
February 9	30	1½
May 4	28	7
August 23	30	8
December 27	30	½
1908.		
April 27	29	3
June 29	29	8
December 24	29	5

38. J. W. Sharp, Santa Fe Springs.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 9	23	10
May 4	23	2½
August 23	24	
December 27	23	8
1908.		
April 27	23	6
June 29	24	2
October 19	24	9
December 24	24	1½

39. John H. Borden, 1½ miles north of Norwalk.

1907.		
February 9	4	3½
May 4	3	6½
August 23	4	1½
December 27	3	2½
1908.		
April 27	1	6
June 29	5	1
October 19	Casing cut off, datum destroyed.	
December 24		

40. Norwalk Builders' Association, Norwalk.

1907.		
February 9	12	1
May 4	14	1
August 23	14	10
December 27	12	5
1908.		
April 27	Pumping.	
June 29	14	3
October 19	13	4
December 24	12	11

41. J. B. Neff, 1½ miles south of Anaheim.

1907.		
January 1	49	1
February 1	47	8
March 1	45	11
April 1	42	9
May 1	39	11
May 31	39	5
June 16	38	10
June 30	39	1
July 27	40	5
September 3	40	
October 1	39	7
October 23	39	
November 7	38	10
November 28	38	10
December 31	38	6
1908.		
January 21	38	10
January 28	38	9
February 12	38	1
February 28	37	5
April 1	37	4
May 1	38	4
June 1	39	10
July 31	42	7
August 31	42	8
October 6	41	7
November 1	41	6
November 28	41	7

Variations of water level in wells in southern California—Continued.

42. Vineland district school, Vineland.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 12	78	10
May 16	64	
August 26	70	
December 30	76	5
1908.		
April 21	72	4
June 23	74	10
October 14	81	
December 27	83	1

43. G. F. Chamberlain, 2 miles southwest of Covina.

1907.		
February 12	103	7
May 16	94	6
August 26	89	6
December 30	91	5
1908.		
April 21	90	9
June 23	91	2½
October 14	95	1
December 27	96	9

44. H. Heinze, Puente.

1907.		
February 12	19	2
May 16	17	
August 26	20	9
December 30	21	1
1908.		
April 21	19	6
June 23	20	8
October 14	22	1
December 27	22	2

45. William Rowland, one-fourth mile south of Rowland.

1907.		
February 12	23	6
May 16	24	2
August 26	25	2
December 30	21	11
1908.		
April 21	23	6
June 23	25	4
October 14	23	5
December 27	22	6

46. B. Yorba, 1½ miles east of Rowland.

1907.		
February 12	28	2
May 16	28	8½
August 26	31	2
December 30	27	7
1908.		
April 21	29	2
June 23	31	5
October 14	30	9
December 27	29	5

47. F. Bowers, Lemon.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 12	17	
May 16	18	4
August 26	21	7
December 30	19	9
1908.		
April 21	19	8
June 23	20	3
October 14	23	1
December 27	20	6

48. S. E. Hicks, one-fourth mile west of Spadra.

1907.		
February 12	34	10
May 16	31	2½
August 26	34	6
December 30	32	6
1908.		
April 21	31	11
June 23	36	7
October 14	36	8
December 27	36	10

49. Sidney Deacon, 2 miles west of San Dimas.

1907.		
February 11	35	3½
May 15	39	6
August 26	43	3
December 30	46	9
1908.		
April 20	47	11
June 22	49	3
October 13	62	7
December 26	67	5

50. William Ferry, 1¼ miles southwest of San Dimas.

1907.		
February 11	202	1
May 15	207	2
August 26	202	4
December 30	202	1
1908.		
April 20	202	8
June 22	202	9
October 13	203	
December 26	203	4

51. Azusa Irrigation Company, San Dimas Wash.

1907.		
February 11	93	1½
1908.		
April 20	52	
June 22	53	7
October 13	56	11
December 26	59	9

Variations of water level in wells in southern California—Continued.

52. Emil Firth, San Dimas Wash.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 11	80	6
May 15	56	8
August 26	72	3
December 30	82	6
1908.		
April 20	86	9
June 22	86	5
October 13	91	10
December 26	94	9

53. Charles Alley, 1 mile northwest of Lordsburg.

1907.		
February 11	152	4
May 15	144	8
August 26	145	2
December 30	143	6
1908.		
April 20	140	5
June 22	142	2
October 13	153	6
December 26	147	7

54. Mr. Massey, three-fourths mile northeast of Lordsburg.

1907.		
February 11	196	3
May 15	191	1
August 26	183	7
December 30	163	6
1908.		
April 20	147	1
June 22	146	
October 13	151	3
December 26	152	6

55. Ontario Water Company, 1 mile north of Claremont.

1907.		
February 11	56	2
May 15	52	1
December 30	54	7
1908.		
April 20	55	10
June 22	57	6
October 13	Pumping.	
December 26	59	4

56. R. Bieley, Claremont.

1907.		
February 11	40	4½
May 15	23	5
August 26	7	2
December 30	7	10
1908.		
April 20	14	3
June 22	17	6
October 13	27	4
December 26	26	½

57. San Antonio Water Company, one-half mile southwest of Claremont.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 11	143	8
May 15	102	7
December 30	29	11½

58. Dr. A. R. Reed, 1½ miles northeast of Pomona.

1907.		
February 11	59	8½
May 15	52	9
August 26	46	7½
December 30	19	5
1908.		
April 20	10	7
June 22	10	9
October 13	14	10
December 26	11	2½

59. B. Linastruth, Pomona.

1907.		
February 11	95	5
May 15	93	7
August 26	93	4
December 30	91	6
1908.		
April 21	90	2
June 23	91	
October 13	Well closed, engine installed.	
December 26		

60. J. J. White, Pomona.

1907.		
February 11	63	5
May 15	65	4
August 26	63	5½
December 30	63	
1908.		
April 20	62	9
June 22	62	9
October 13	63	2
December 26	62	9

61. Mrs. Tieg, 1½ miles southeast of Pomona.

1907.		
February 11	91	6½
May 15	90	3½
August 26	91	7
December 30	90	
1908.		
April 20	92	7
June 22	Pumping.	
October 13	Pumping.	
December 26	91	4

Variations of water level in wells in southern California—Continued.

62. R. Riemers, 2½ miles southeast of Pomona.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 11	35	4
May 5	33	4
August 26	35	
December 30	35	11
1908.		
April 20	34	10
June 22	37	
October 13	37	1
December 26	36	

63. C. P. Brown, 2¼ miles southeast of Pomona.

1907.		
February 11	4	4
August 26	12	1
December 30	5	7
1908.		
April 20	12	
June 22	11	1
October 13	6	11
December 26	4	1

64. Mr. Haley, one-fourth mile west of San Bernardino.

1907.	*Feet.*
June 1	9.2
November	14.27

65. C. W. Rogers, 1 mile east of Colton.

1907.	
June 1	4.33
November	11.35

67. Riverside Water Company, Third and Waterman streets, San Bernardino.

Date of measurement.	Yield in miner's inches.
1907.	
June 1	Capped.
November	140.8

68. N. B. Hinkley estate, three-fourths mile west of Bryn Mawr.

Date of measurement.	Depth to water.
1907.	*Feet.*
June 1	67.1
November	71.3

69. Riverside County, 2½ miles south of Alessandro.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 13	51	3
May 17	61	8
August 30	52	
December 31	52	1
1908.		
April 22	52	
June 24	53	4
October 16	52	5
December 29	52	3

70. Well 4 miles northeast of Perris.

1907.		
February 13	30	4
May 17	30	4
August 30	30	7½
December 31	30	9
1908.		
April 22	30	4
June 24	31	2
October 16	32	6
December 29	31	7

71. C. Lossman, 2½ miles north of Perris.

1907.		
February 13	63	3½
May 17	67	9
August 30	63	11
December 31	64	
1908.		
April 22	64	1
June 24	Pumping.	
October 16	65	2
December 29	66	

72. Crawford Carter, Perris.

1907.		
February 13	32	
May 18	32	2½
1908.		
April 22	34	11
June 25	36	
October 15	37	5
December 28	37	3

73. Mrs. L. R. Harford, 3½ miles east of Perris.

1907.		
February 14	41	10½
May 18	40	4
August 31	40	9
December 31	43	1
1908.		
April 23	41	11
June 25	43	5
October 15	46	6
December 28	46	8½

Variations of water level in wells in southern California—Continued.

74. E. E. Waters, Ethanac.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 14	43	3
August 31	49	
December 31	47	11½
1908.		
April 23	39	1
June 25	45	7
October 15	46	3
December 28	45	4

75. Temescal Water Company, 1¼ miles west of Ethanac.

1907.		
February 14	29	2½
May 18	27	11
August 31	31	
December 31	31	11
1908.		
April 23	31	7
June 25	33	5
October 15	35	
December 28	35	3

76. Dr. Reese, 2¼ miles south of Perris.

1907.		
February 14	15	8½
May 18	15	9
December 31	16	7
1908.		
April 23	17	11
June 25	16	9
October 15	17	8
December 28	18	

77. William Newport, 4½ miles south of Perris.

1907.		
February 14	38	9
August 31	38	10
December 31	40	5
1908.		
April 23	39	6
June 25	40	6
October 15	42	8
December 28	43	7

78. William Newport, Menifee Valley.

1907.		
February 14	19	10½
May 18	18	3
August 30	19	8½
December 31	20	8
1908.		
April 23	19	7
June 25	20	5
October 15	21	6
December 28	21	11

79. H. H. Lindenberger, 4 miles southwest of Winchester.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 14	13	6
May 18	11	
August 30	13	4
December 31	14	2
1908.		
April 23	Pumping.	
June 25	9	2
October 15	11	
December 28	Pumping slowly. 10	11

80. M. M. Patterson, Winchester.

1907.		
February 14	19	8
May 18	18	10
August 31	18	10
December 31	19	2
1908.		
April 23	18	8
June 25	19	2
October 15	19	7
December 28	19	7

81. Mrs. Maud F. Walker, 3 miles southwest of Hemet.

1907.		
February 14	9	3
August 30	9	8½
December 31	9	8½
1908.		
April 23	9	4
June 25	9	6
October 15	20	6
December 28	Not accessible.	

82. J. E. Garrigan, 1 mile west of Hemet.

1907.		
February 13	32	
May 18	32	6
August 31	32	6
December 31	31	10
1908.		
April 23	31	11
June 25	31	9
October 15	31	1
December 28	31	8

Variations of water level in wells in southern California—Continued.

83. Mrs. Ruby Hewitt, one-half mile east of Bowers.

Date of measurement.	Condition of water.
1907.	
August 30	Flowing.
December 31	Flowing.

84. J. Carmichael, Bowers.

Date of measurement.	Condition of water.
1907.	
February 13	Flowing.
May 18	Flowing.
August 30	(a)
December 31	(b)

85. K. D. Harger, Lakeview.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 13	29	4½
May 17	28	9
August 30	29	1
December 31	29	4
1908.		
April 22	28	10
June 24	28	10
October 16	29	1
December 29	29	½

a Flowing 1 miner's inch.

b Flowing as strong as in August.

INDEX.

A.

Page.

Accuracy, degree of 29
Acknowledgments to those aiding 30–31
Acre-foot, definition of 16
Alabama Hills, Cal.,
  Owens River at:
    discharge 333
Alamo River near—
  Brawley, Cal.:
    description 45
    discharge 46
Alessandro, Cal., ground water near 345
American River basin:
    description 220–221
    gaging station 221
    stream flow 221–225
American River near—
  Fairoaks, Cal.:
    description 221–222
    discharge 222
    discharge, monthly 224–225
    gage heights 222–223
    rating tables 224
Anaheim, Cal., ground water near 343
Anna Creek in or near—
  Arrants, Oreg.:
    discharge 337
  Sec. 16, T. 33, R. 7 E.
    discharge 337
Anna Creek Spring at—
  Arrants, Oreg.:
    discharge 337
Appropriations, amount of 9
Arrants, Oreg.,
  Anna Creek near:
    discharge 337
  Anna Creek Spring at:
    discharge 337
Arrowhead Hotel, Cal.,
  East and West Twin Creek at:
    discharge 335
Arroyo Seco near—
  Millard Canyon, Cal.:
    discharge 336
  Soledad, Cal.:
    description 146
    discharge 147
    discharge, monthly 149
    gage heights 147–148
    rating table 148
Ash Creek near—
  Olancha, Cal.:

Page.

    description 97
    discharge 98
    discharge, monthly 99
    gage heights 98
    rating table 99
Auburndale Bridge, Cal.,
  Santa Ana River at:
    discharge 131
Authority for investigations, recital of 9
Azusa, Cal.,
  San Gabriel power canal near:
    description 133
    discharge 134
    discharge, daily 136–137
  San Gabriel River near:
    description 133
    discharge 134
    discharge, monthly 137–138
    gage heights 134–135
    rating tables 135–136

B.

Bairs Creek near—
  Thebe, Cal.:
    description 88
    discharge 88
    discharge, monthly 89
Baker Creek near—
  Big Pine, Cal.:
    description 66
    discharge 67
Bakersfield, Cal.,
  Kern River near:
    description 239–240
    discharge 240
    discharge, monthly 241
Barrows, A. T., work of 31
Bear River at—
  Van Trent, Cal.:
    description 217
    discharge 217
    discharge, monthly 220
    gage heights 218
    rating tables 219
Bear River basin:
    description 216–217
    gaging station 217
    stream flow 217–220
Bee Creek ditch:
    discharge 166

Page.
Beetles Rest Springs at—
Klamath Agency, Oreg.:
discharge 337
Bernardo River basin:
description 115–116
gaging station 116
stream flow 116–119
Bieber, Cal.,
Pit River near:
description 159–160
discharge 160
discharge, monthly 162
gage heights 160–161
rating table 161
Big Bend, Cal.,
Feather River, North Fork, near:
description 195
discharge 196
discharge, daily 197
discharge, monthly 198
gage heights 196
rating table 197
Big Pine, Cal.,
Baker Creek near:
description 66
discharge 67
Big Pine Creek near:
description 67
discharge 67–68
discharge, monthly 69
gage heights 68
rating table 69
Big Pine canal near—
Center School, Cal.:
discharge 334
Birch Creek near—
Tinemaha, Cal.:
description 70
discharge 70
discharge, monthly 71–72
gage heights 70–71
Bishop, Cal.,
Bishop Creek canal near:
discharge 334
Collins canal near:
discharge 334
Farmers' canal near:
discharge 334
McNalley canal near:
discharge 334
Rawson canal near:
discharge 334
Bishop Creek canal near—
Bishop, Cal.:
discharge 334
Bishop Creek near—
Bishop, Cal.:
description 64
discharge 64
discharge, monthly 66
gage heights 65
rating table 66
Black Rock Springs near—
Independence, Cal.:
discharge 333
Blake and Miller canal:
discharge 334
Bowers, Cal., ground water at and near 348

Page.
Brawley, Cal.,
Alamo and New Rivers near:
description 45
discharge 46
Briscoe Creek near—
Elk Creek, Cal.:
discharge 336
Brownell, Cal.,
Fords Springs at:
discharge 338
Lower Klamath Lake near:
description 309
gage heights 309–310
Willow Creek at:
discharge 338
Bryn Mawr, Cal., ground water near 345
Bubbs Creek Falls on—
Kings River:
view 250
Butler ranch, Cal.,
Coyote Creek at:
discharge 333
Butt Creek at—
Butte Valley, Cal.:
description 204
discharge 205
discharge, monthly 207
gage heights 205–206
rating tables 206
Butte Valley, Cal.,
Butt Creek at:
description 204
discharge 205
discharge, monthly 207
gage heights 205–206
rating tables 206

C.

Cache Creek at or near—
Lower Lake, Cal.:
description 177
discharge 177
discharge, monthly 179
gage heights 177–178
rating table 178
Yolo, Cal.:
description 179–180
discharge 180
discharge, monthly 182
gage heights 180–181
rating tables 181–182
Cache Creek basin:
description 175–176
gaging stations 176
stream flow 177–182
Calaveras River at—
Jenny Lind, Cal.:
description 289–290
discharge 290
discharge, monthly 292
gage heights 290–291
rating table 291
Calaveras River basin:
description 288–289
gaging station 289
stream flow 289–292
California, cooperation of 30–31

Page.
California, southern, fluctuations of ground water in ... 338–348
wells in, location of, map showing ... 338
Carroll Creek:
discharge ... 334
Castle ditch:
discharge ... 131
Center School, Cal.,
Big Pine canal near:
discharge ... 334
Charlies Butte, Cal.,
Seeley Springs near:
discharge ... 333
Cherry Creek:
discharge ... 337
Chillaquin Bridge, Oreg.,
Williamson River at:
discharge ... 337
Chino Creek:
discharge ... 335
Cienaga, Cal., ground water near ... 341
Citrus, Cal.,
East Side canal near:
discharge ... 334
Owens River at:
discharge ... 333
Stevens canal near:
discharge ... 334
City Creek at—
Highland, Cal.:
discharge ... 335
Clapp, W. B., work of ... 31
Claremont, Cal., ground water at and near ... 345
Clear Lake, Cal.,
Lost River near:
description ... 318–319
discharge ... 319
discharge, monthly ... 321
gage heights ... 319–320
rating tables ... 320–321
Clements, Cal.,
Mokelumne River near:
description ... 294
discharge ... 294
discharge, monthly ... 296–297
gage heights ... 295
rating tables ... 296
Collins canal near—
Bishop, Cal.:
discharge ... 334
Colorado River at—
Hardyville, Ariz.:
description ... 31–32
discharge ... 32
discharge, daily ... 33
discharge, monthly ... 33
gage heights ... 32
Yuma, Ariz.:
description ... 33–34
discharge ... 34–35
discharge, daily ... 37
discharge, monthly ... 38
gage heights ... 36
Colorado River basin:
stream flow ... 31–46
Colton, Cal., ground water near ... 346

Page.
Computing, office methods of ... 24–28
Convict Creek in—
Long Valley, Cal.:
discharge ... 333
Cooperation, credit for ... 30–31
Cosumnes River at—
Michigan Bar, Cal.:
description ... 298
discharge ... 298
discharge, monthly ... 300
gage heights ... 299
rating table ... 299
Cosumnes River basin:
description ... 297–298
gaging station in ... 298
stream flow ... 298–300
Cottonwood Creek (of Lower Klamath Lake):
discharge ... 338
Cottonwood Creek (of Owens Lake) near—
Los Angeles aqueduct intake:
discharge ... 334
Olancha, Cal.:
description ... 94
discharge ... 95
discharge, monthly ... 97
gage heights ... 95–96
rating tables ... 96
South Fork:
discharge ... 334
Cottonwood Creek (of Sacramento River) basin:
description ... 165
gaging station ... 165
stream flow ... 165–168
Cottonwood Creek (of Sacramento River), North Fork, at—
Ono, Cal.:
canals from, discharge ... 166
description ... 165–166
discharge ... 166
discharge, monthly ... 168
gage heights ... 166–167
rating table ... 167
Cottonwood Creek (of Tia Juana River) near—
Jamul, Cal.:
description ... 102
discharge ... 102
discharge, monthly ... 103
Covina, Cal., ground water near ... 344
Cow Creek, South Fork:
discharge ... 336
Coyote Creek at—
Butler ranch:
discharge ... 333
Crane Creek:
discharge ... 337
Crescent Mills, Cal.,
Indian Creek near:
discription ... 208
discharge, monthly ... 210
gage heights ... 209
rating table ... 210
Crooked Creek in—
Long Valley, Cal.:
discharge ... 333

Page.
Crooked River at—
Klamath Agency, Oreg.:
discharge 337
Current meter, description of 21-22
use of 20, 22-23
views of 22
Current-meter station, view of 20
Curves, discharge, figure showing 25

D.

Definitions, statements of 15-16
Dell canal:
discharge 334
Descanso, Cal.,
Sweetwater River near:
description 106
discharge 107
discharge, monthly 109
gage heights 107-108
Discharge, computation of 24-28
curves for, figure showing 25
measurement of 18-23
Discharge measurements, nature of 17.18
Division Creek at or near—
Independence, Cal.:
description 79
discharge 79-80
discharge, monthly 81
gage heights 80
mouth of canyon:
discharge 333
Dorris, Cal.,
Dorris Creek at:
discharge 338
Sheepy Creek near:
discharge 338
Drainage, stream flow and 11-12
Drainage basins, list of 12
Durkee ditch:
discharge 131

E.

East Highlands, Cal.,
Plunge Creek at:
discharge 335
East Park dam site, Cal.,
Little Stony Creek near:
view 168
East Side canal at—
Citrus, Cal.:
discharge 334
East Twin Creek near—
Arrowhead Hotel:
discharge 335
Elk Creek, Cal.,
Briscoe Creek near:
discharge 336
Elk Creek near:
discharge 336
Salt Creek near:
discharge 336
Ellsworth, C. E., work of 31
El Monte, Cal., ground water at and near 342-343
Equivalents, list of 16-17
Escondido, Cal.,
Santa Ysabel Creek near:
description 116
discharge 117
discharge, monthly 118-119
gage heights 117-118

Page.
Ethanac, Cal., ground water at and near 347
Evaporation at—
Keno, Oreg.:
description 331-332
records 332

F.

Fairoaks, Cal.,
American River near:
description 221-222
discharge 222
discharge, monthly 224-225
gage heights 222-223
rating table 224
Fall Creek:
discharge 336
Farmers canal near—
Bishop, Cal.:
discharge 334
Feather River at—
Oroville, Cal.:
description 199
discharge 199
discharge, monthly 202
gage heights 200
rating tables 201-202
Feather River basin:
description 187-190
gaging stations 190
stream flow 190-220
Feather River, North Fork, near—
Big Bend, Cal.:
description 195
discharge 196
discharge, daily 197
discharge, monthly 198
gage heights 196
rating table 197
(above) Prattville, Cal.:
description 190
discharge 190
discharge, monthly 191-192
gage heights 191
rating tables 191
(below) Prattville, Cal.:
description 192-193
discharge 193
discharge, monthly 195
gage heights 193-194
rating table 194
Field practice, methods of 18-23
Fish Springs:
discharge 333
Float method, description of 21
Flood prevention, stream flow and 12
Fords Springs at—
Brownell, Cal.:
discharge 338
Forest Home, Cal.,
Mill Creek at:
discharge 335
Fort Creek in or near—
Fort Klamath, Oreg.:
discharge 337
Sec. 27, T. 33 S., R. 6 E.
discharge 337

Page.
Fort Klamath, Oreg.,
Fort Creek near:
discharge ... 337
Wood River at:
discharge ... 337
Fourmile Creek:
discharge ... 337
Fruto, Cal.,
Stony Creek near:
description ... 169–170
discharge ... 170
discharge, monthly ... 172–173
gage heights ... 170–171
rating tables ... 171–172
view of ... 168
Fuller ditch:
discharge ... 131

G.

Gage heights, nature of ... 17
Gaging station, classification of ... 24–28
description of ... 20
view of ... 20
Gardena, Cal., ground water near ... 340
George Creek near—
Thebe, Cal.:
description ... 89
discharge ... 89
discharge, monthly ... 90
Gilliland ditch:
discharge ... 131
Goodale Creek near—
Tibbetts, Cal.:
description ... 77
discharge ... 77
discharge, monthly ... 79
gage heights ... 78
Great Basin:
description ... 46
stream flow ... 52–100
See also subordinate basins.
Gregory, Cal.,
McCloud River near:
description ... 162
discharge ... 164
gage heights ... 163
rating table ... 164
Grieve's ranch, Oreg.,
Jenny Creek at:
discharge ... 336
Grindstone Creek near—
Stony Creek, Cal.:
discharge ... 336
Ground water, fluctuations of ... 338–348

H.

Hamilton Branch near—
Prattville, Cal.:
description ... 202–203
discharge ... 203
discharge, monthly ... 204
gage heights ... 203
rating table ... 203

Page.
Happy Valley ditch:
discharge ... 166
Hardy, W. V., work of ... 31
Hardyville, Ariz.,
Colorado River at:
description ... 31–32
discharge ... 32
discharge, daily ... 33
discharge, monthly ... 33
gage heights ... 32
Hawley, R. S., work of ... 31
Hemet, Cal., ground water near ... 347
Hendricks, L. F., work of ... 31
Henshaw, F. F., work of ... 31
Herndon, Cal.,
San Joaquin River at:
description ... 231
gage heights ... 232
Highland, Cal.,
City Creek at:
discharge ... 335
Hilton Creek in—
Long Valley, Cal.:
discharge ... 333
Honey Lake basin:
description ... 47
gaging stations ... 47
Horton Creek:
discharge ... 333
Hot Creek in—
Long Valley, Cal.:
discharge ... 333
Howard Summit, Cal., ground water near ... 340

I.

Ice, measurements under ... 23, 28
Independence, Cal.,
Black Rock Springs near:
discharge ... 333
Division Creek near:
description ... 79
discharge ... 79–80
discharge, monthly ... 81
gage heights ... 80
Independence Creek near:
description ... 85
discharge ... 85
discharge, monthly ... 87
gage heights ... 86
Oak Creek near:
description ... 82
discharge ... 83
discharge, monthly ... 84
gage heights ... 83–84
Sawmill Creek near:
description ... 81
discharge ... 82
Symmes Creek near:
discharge ... 334
Thibaut Creek near:
description ... 82
discharge ... 82

Page.
Indian Creek near—
Crescent Mills, Cal.:
description 208
discharge, monthly 210
gage heights 209
rating table 210
Investigations, authority for 9
purposes of 11–12
scope of 10
Irrigation, stream flow and 11
Ivy, Cal., ground water at and near 341

J.

Jamul, Cal.,
Cottonwood Creek near:
description 102
discharge 102
discharge, monthly 103
Pine Valley Creek near:
description 103
discharge 104
discharge, monthly 104
Jenny Creek at—
Grieve's ranch, Oreg.:
discharge 336
Jenny Lind, Cal.,
Calaveras River at:
description 289–290
discharge 290
discharge, monthly 292
gage heights 290–291
rating table 291
Jerusalem ditch:
discharge 166
Jones Creek:
discharge 337

K.

Kaweah River basin:
description 245–246
gaging station 246
stream flow 247–249
Kaweah River near:
Three Rivers, Cal.:
description 247
discharge 247
discharge, monthly 249
discharge curves for, chart showing 25
gage heights 248
rating table 249
Keno, Oreg.,
Klamath River at:
description 314
discharge 314
discharge, monthly 316
evaporation 331–332
gage heights 315
rating table 316
Kern River basin:
description 237–239
gaging station 239
stream flow 239–241
Kern River near—
Bakersfield, Cal.:
description 239–240
discharge 240
discharge, monthly 241
Kimball, Howard, work of 31

Page.
Kings River basin:
description 250–251
gaging station 251
stream flow 251–255
Kings River at or near—
Bubbs Creek Falls:
view 250
Kings River near—
Sanger, Cal.:
description 251–252
discharge 252
discharge, monthly 254–255
gage heights 253
rating tables 254
Klamath Agency, Oreg.,
Beetles Rest Springs:
discharge 337
Crooked River at:
discharge 337
Tecumseh Creek near:
discharge 337
Williamson River near:
description 316–317
discharge 317
discharge, monthly 319
gage heights 317
rating table 318
Klamath Falls, Oreg.,
Klamath project canal at:
discharge 337
view 270
Klamath River below:
description 310
gage heights 311, 312, 313
Link River at:
description 303–304
discharge 305
discharge, daily 308
discharge, monthly 308–309
gage heights 306–307
rating tables 307–308
Moore Bros.' power flume at:
discharge 337
Upper Klamath Lake near:
description 302
gage heights 302–303
Klamath Lakes. *See* Upper Klamath; Lower Klamath.
Klamath River at or below—
Keno, Oreg.:
description 314
discharge 314
discharge, monthly 316
gage heights 315
rating table 316
Klamath Falls, Oreg.:
description 310
gage heights 311, 312, 313
Woodsbridge, Cal.:
discharge 336
Klamath River basin:
description 300–301
gaging stations 302
miscellaneous measurements 336–338
rainfall 301
stream flow 302–331

Page.
Knights Ferry, Cal.,
Stanislaus River at:
description 282
discharge 283
discharge, monthly 285
gage heights 283–284
rating tables 284–285
Stanislaus Water Co.'s canal at:
description 285–286
discharge 286
discharge, monthly 288
gage heights 286–287
rating table 287

L.

Lagrange, Cal.,
Lagrange Water and Power Co.'s canal near:
description 279
discharge 280
discharge, daily 280
Modesto canal near:
description 274
discharge 274
discharge, monthly 276
gage heights 274–275
rating table 276
Tuolumne River at:
description 269–270
discharge 270
discharge, monthly 273
gage heights 270–271
rating tables 272
Lagrange dam, Cal.,
Tuolumne River at:
description 269–270
gage heights 271
rating table 273
view 270
Turlock canal near:
description 277
discharge 277
discharge, monthly 279
gage heights 277–278
rating table 278
Lakeside, Cal.,
San Diego flume near:
description 110–111
discharge 113
discharge 115
gage heights 113–114
rating table 115
San Diego River near:
description 110–111
discharge 111
discharge, monthly 113
gage heights 111–112
Lakeview, Cal., ground water at 348
Lamb, W. A., work of 21
Le Gay ditch:
discharge 131
Lemon, Cal., ground water at 344
Levening Creek:
discharge 332
Link River at—
Klamath Falls, Oreg.:
description 303–304
discharge 305
discharge, daily 308

Page.
Link River at—
Klamath Falls, Oreg.—Continued.
discharge, monthly 308–309
gage heights 306–307
rating table 307–308
Little Rock Creek near—
Little Rock, Cal.:
discharge 335
Little Stony Creek near—
East Park dam site:
view 168
Lodoga, Cal.:
description 173
discharge 173
discharge, monthly 175
gage heights 174
rating table 174
Rockville, Cal.:
discharge 336
Lodoga, Cal.,
Little Stony Creek near:
description 173
discharge 173
discharge, monthly 175
gage heights 174
rating table 174
Lompoc, Cal.,
Santa Ynez River near:
description 142
discharge 142
discharge, monthly 144
gage heights 143
rating tables 144
Lone Pine, Cal.,
Owens River near:
discharge 333
Lone Pine Creek near:
description 90
discharge 90
discharge, monthly 92
gage heights 91
Tuttle Creek near:
description 92
discharge 92–93
discharge, monthly 94
gage heights 93–94
Long Valley, Cal.,
Convict Creek in:
discharge 333
Crooked Creek in:
discharge 333
Hilton Creek in:
discharge 333
Hot Creek in:
discharge 333
Magee Creek in:
discharge 333
Owens River in:
discharge 333
Lordsburg, Cal., ground water near 345
Lorella, Oreg.,
Miller Creek near:
description 329
discharge 329
discharge, monthly 331
gage heights 329–330
rating table 331

Page.
Los Angeles, Cal., ground water at..... 341
Los Angeles River at—
Los Angeles, Cal.:
discharge..... 336
Los Angeles River basin:
description..... 138
diversions from..... 138-139
discharge..... 139
miscellaneous measurements..... 336
Lost River at or near—
Clear Lake, Cal.:
description..... 318-319
discharge..... 319
discharge, monthly..... 321
gage heights..... 319-320
rating tables..... 320-321
Merrill, Oreg.:
description..... 324-325
discharge..... 325
discharge, daily..... 327
discharge, monthly..... 327
gage heights..... 326
Olene, Oreg.:
description..... 321-322
discharge..... 322
discharge, monthly..... 324
gage heights..... 323
rating table..... 324
Lower Klamath Lake basin:
miscellaneous measurements..... 338
Lower Klamath Lake near—
Brownell, Cal.:
description..... 309
gage heights..... 309-310
Lower Lake, Cal.,
Cache Creek at:
description..... 177
discharge..... 177
discharge, monthly..... 179
gage heights..... 177-178
rating table..... 178

M.

McCloud River near—
Gregory, Cal.:
description..... 162
discharge, monthly..... 164
gage heights..... 163
rating table..... 164
McGlashan, H. D., work of..... 31
McNally canal near—
Bishop, Cal.:
discharge..... 334
Magee Creek in—
Long Valley, Cal.:
discharge..... 333
Round Valley, Cal.:
discharge..... 333
Marina Gold Mining Co.'s ditch:
discharge..... 166
Martin, W. F., work of..... 31
Mendenhall, W. C., on fluctuations of ground water..... 338-348
Menifee Valley, Cal., ground water at..... 347
Mentone, Cal.,
Mentone Power Co.'s canal near:
description..... 124-125
discharge..... 125
discharge, daily..... 127-128

Mentone, Cal.—Continued. Page.
Santa Ana River near:
Canals from, discharge..... 131
description..... 124-125
discharge..... 125
discharge, monthly..... 128
gage heights..... 125-126
rating table..... 126-127
Merced Falls, Cal.,
Merced River above:
description..... 259-260
discharge..... 260
discharge, monthly..... 263
gage heights..... 260-261
rating tables..... 261-262
Merced River basin:
description..... 255-256
gaging stations..... 256
stream flow..... 256-267
Merced River above or in—
Merced Falls, Cal.:
description..... 259-260
discharge..... 260
discharge, monthly..... 263
gage heights..... 260-261
rating tables..... 261-262
Yosemite Valley, Cal.:
description..... 256-257
discharge..... 257
discharge, monthly..... 259
gage heights..... 257-258
rating table..... 258
Merrill, Oreg.,
Lost River near:
description..... 324-325
discharge..... 325
discharge, daily..... 327
discharge, monthly..... 327
gage heights..... 326
Tule Lake near:
description..... 327
gage heights..... 328
Michigan Bar, Cal.,
Cosumnes River at:
description..... 298
discharge..... 298
discharge, monthly..... 300
gage heights..... 299
rating table..... 299
Millard Canyon, Cal.,
Arroyo Seco near:
discharge..... 336
Mill Creek at or near—
Edison power plant:
discharge..... 335
Forest Home, Cal.:
discharge..... 335
Miller Creek near—
Lorella, Oreg.:
description..... 329
discharge..... 329
discharge, monthly..... 331
gage heights..... 329-330
rating table..... 331
Miner's inch, definition of..... 15
Miscellaneous measurements:
Great Basin..... 332-335
Klamath River drainage..... 336-338
San Francisco Bay drainage..... 336
South Pacific drainage..... 335-336

Modesto Canal near— Page.
Lagrange, Cal.:
description 274
discharge 274
discharge, monthly 276
gage heights 274–275
rating tables 276
Moffett Creek. *See* Bairs Creek.
Mohave River basin:
description 99–100
gaging station 100
miscellaneous measurements 335
Mokelumne River basin:
description 292–294
gaging station 294
stream flow 294–297
Mokelumne River near—
Clements, Cal.:
description 294
discharge 294
discharge, monthly 296–297
gage heights 295
rating tables 296
Moneta, Cal., ground water near 340
Mono Lake basin:
description 47–48
miscellaneous measurements 332
Moss Creek:
discharge 337

N.

Navigation, stream flow and 11
Newberry ditch:
discharge 131
New River, stream erosion on, view of 42
New River near—
Brawley, Cal.:
description 45
discharge 46
Newton ditch:
discharge 131
North Pacific Ocean drainage:
stream flow 300–331
Norwalk, Cal., ground water at and near 342

O.

Oak Creek near—
Independence, Cal.:
description 82
discharge 83
discharge, monthly 84
gage heights 83–84
Office practice, methods of 24–28
Olancha, Cal.,
Ash Creek near:
description 97
discharge 98
discharge, monthly 99
gage heights 98
rating table 99
Cottonwood Creek near:
description 94
discharge 95
discharge, monthly 97
gage heights 95–96
rating tables 96
Old Cow Creek: Page.
discharge 336
Olene, Oreg.,
Lost River at:
description 321–322
discharge 322
discharge, monthly 324
gage heights 323
rating table 324
Ono, Cal.,
Cottonwood Creek, North Fork, at:
canals from, discharge 166
description 165–166
discharge 166
discharge, monthly 168
gage heights 166–167
rating table 167
Oroville, Cal.,
Feather River at:
description 199
discharge 199
discharge, monthly 202
gage heights 200
rating tables 201–202
Owens River at or near
Alabama Hills, Cal.:
discharge 333
Citrus, Cal.:
discharge 333
Lone Pine, Cal.:
discharge 333
Round Valley, Cal.:
description 52
discharge 53
discharge, monthly 55
gage heights 53–54
rating tables 54
Thompson ranch:
discharge 333
Tinemaha, Cal.:
description 55
discharge 56
discharge, monthly 58
gage heights 57
rating tables 58
Owens River basin:
canals, miscellaneous measurements 334
description 49–52
gaging stations 51–52
miscellaneous measurements 333–334
stream flow 52–99
Owens River canal:
discharge 334

P.

Pacific Ocean drainage. *See* North Pacific; South Pacific; San Francisco.
Padgett, H. D., work of 31
Pala, Cal.,
San Luis Rey River near:
description 120
discharge 121
discharge, monthly 122
gage heights 121–122
Pallett Creek near—
Rock Creek, Cal.:
discharge 335

Page.
Palms, Cal., ground water at 341
Parker, G. L., work of 31
Pasadena, Cal., ground water at and near 342
Perris, Cal., ground water at and near 346–347
Pine Creek near—
Round Valley, Cal.:
description 61
discharge 62, 333
discharge, monthly 63
gage heights 62–63
Pine Valley Creek near—
Jamul, Cal.:
description 103
discharge 104
discharge, monthly 104
Pit River basin:
description 157–159
gaging station 159
stream flow 159–164
Pit River near—
Bieber, Cal.:
description 159–160
discharge 160
discharge, monthly 162
gage heights 160–161
rating table 161
Plunge Creek at—
East Highland, Cal.:
discharge 335
Pollasky, Cal.,
San Joaquin River near:
description 229
discharge 229
discharge, monthly 231
gage heights 230
rating table 231
Pomona, Cal., ground water at and near 345–346
Portersville, Cal.,
Tule River near:
description 243
discharge 243
discharge, monthly 245
gage heights 243–244
rating table 244
Post, R. B., work of 31
Prattsville, Cal.,
Feather River, North Fork, above:
description 190
discharge 190
discharge, monthly 191–192
gage heights 191
rating tables 191
Feather River, North Fork, below:
description 192–193
discharge 193
discharge, monthly 195
gage heights 193–194
rating table 194
Hamilton Branch near:
description 202–203
discharge 203
discharge, monthly 204
gage heights 203
rating table 203
Publications, lists of 12–15
Puente, Cal., ground water at 344

Page.
Puta Creek at—
Winters, Cal.:
description 184
discharge 184
discharge, monthly 187
gage heights 185
rating tables 186
Puta Creek basin:
description 183
gaging station 184
stream flow 184–187

R.

Rating curves, construction of and use of 24
Rating tables, construction of 24
nature of 18
Rawson, canal near—
Bishop, Cal.:
discharge 334
Red Bluff, Cal.,
Sacramento River near:
description 156
discharge 155
discharge, monthly 157
gage heights 155–156
rating table 156
Revision, need for 30
Rice, R. C., work of 31
Rincon, Cal.,
Santa Ana River at:
discharge 335
Roberts ditch:
discharge 131
Rock Creek (of Mohave Desert) near—
Pallett Creek, Cal.:
discharge 335
Shoemaker, Cal.:
discharge 335
Rock Creek (of Owens River) near—
Round Valley, Cal.:
description 59
discharge 59
discharge, monthly 61
gage heights 59–60
rating tables 60–61
Rock Creek (of Upper Klamath Lake):
discharge 337
Rockville, Cal.,
Little Stony Creek near:
discharge 336
Stony Creek at and near:
discharge 336
Round Valley, Cal.,
Horton Creek in:
discharge 333
Magee Creek in:
discharge 333
Owens River near:
description 52
discharge 53
discharge, monthly 55
gage heights 53–54
rating tables 54
Pine Creek near:
description 61
discharge 62, 333
discharge, monthly 63
gage heights 62–63

Round Valley, Cal.—Continued. Page.
Rock Creek near:
description 59
discharge 59
discharge, monthly 61
gage heights 59–60
rating tables 60–61
Rowland, Cal., ground water near 344
Run-off, computation of 24–28
definition of 15
Rush Creek:
discharge 332

S.

Sacramento River basin:
description 149–152
gaging stations 153
miscellaneous measurements 336
stream flow 153–225
Sacramento River near—
Red Bluff, Cal.:
description 154
discharge 155
discharge, monthly 157
gage heights 155–156
rating table 156
Sacramento Valley:
description 153–154
Salinas River basin:
description 145–146
gaging stations 146
stream flow 146–149
Salt Creek near—
Elk Creek, Cal.:
discharge 336
Salton Sea:
description 38–43
flood 41–43
measurements 43–46
Salton Sea near—
Salton, Cal.:
description 43
inflow 44
gage heights 44–45
rise 45
view 42
San Bernardino, Cal., ground water in and near 346
San Bernardino Valley between—
Slover Mountain and Riverside Narrows, Cal.:
seepage to 130–131
San Diego flume near—
Lakeside, Cal.:
description 110–111
discharge 113
discharge, monthly 115
gage heights 113–114
rating table 115
San Diego River basin:
description 109–110
gaging station 110
stream flow 110–115
San Diego River near—
Lakeside, Cal.:
description 110–111
discharge 111
San Diego River near— Page.
Lakeside, Cal.—Continued.
discharge, monthly 113
gage heights 111–112
San Dimas, ground water near 344
San Dimas Wash, ground water in 344–345
San Francisco Bay drainage:
description 149
miscellaneous measurements 336
stream flow 149–300
San Gabriel, Cal., ground water near 342
San Gabriel power canal near—
Azusa, Cal.:
description 133
discharge 134
discharge, daily 136–137
San Gabriel River basin:
description 131–133
gaging station 133
stream flow 133–138
San Gabriel River near—
Azusa, Cal.:
description 133
discharge 134
discharge, monthly 137–138
gage heights 134–135
rating tables 135–136
Sanger, Cal.—
Kings River near:
description 251–252
discharge 252
discharge, monthly 254–255
gage heights 253
rating tables 254
San Joaquin River at or near—
Herndon, Cal.:
description 231
gage heights 232
Pollasky, Cal.:
description 229
discharge 229
discharge, monthly 231
gage heights 230
rating table 231
San Joaquin River system:
description 225–229
gaging stations 229
stream flow 229–300
San Luis Rey River at or near—
Pala, Cal.:
description 120
discharge 121
discharge, monthly 122
gage heights 121–122
Warner's ranch, Cal.:
discharge 335
San Luis Rey River basin:
description 119–120
gaging station 120
miscellaneous measurements 335
Santa Ana River at or near—
Auburndale Bridge, Cal.:
discharge 131
Mentone, Cal.:
canals from, discharge 131
description 124–125
discharge 125

Page.
Santa Ana River at or near—
Mentone, Cal.—Continued.
discharge, monthly 128
gage heights 125–126
rating tables 126–127
Rincon, Cal.:
discharge 335
Santa Ana River basin:
description 123–124
gaging station 124
miscellaneous measurements 335
seepage measurements 129–131
stream flow 124–131
Santa Barbara, Cal.:
Santa Ynez River near:
description 140
discharge, monthly 142
gage heights 141
rating table 141
Santa Fe Springs, Cal., ground water at 343
Santa Margarita River basin:
miscellaneous measurements 335
Santa Ynez River basin:
description 139–140
gaging stations 140
stream flow 140–144
Santa Ynez River near—
Lompoc, Cal.:
description 142
discharge 142
discharge, monthly 144
gage heights 143
rating tables 144
Santa Barbara, Cal.:
description 140
discharge, monthly 142
gage heights 141
rating table 141
Santa Ysabel Creek near—
Escondido, Cal.:
description 116
discharge 117
discharge, monthly 118–119
gage heights 117–118
Savannah, Cal., ground water near 342
Sawmill Creek near—
Independence, Cal.:
description 81
discharge 82
Schell ditch:
discharge 286
Second-foot, definition of 15
Section, changes in, estimation of 25–28
Seeley Springs near—
Charlies Butte:
discharge 333
Seepage, measurements of 129–131
Sevenmile Creek:
discharge 337
Shasta River near—
Yreka, Cal.:
discharge 336
Sheepy Creek near—
Dorris, Cal.:
discharge 338

Page.
Shepard Creek near—
Thebe, Cal.:
description 87
discharge 87
discharge, monthly 88
Sherman, Cal., ground water near 341–342
Shoemaker, Cal.,
Rock Creek near:
discharge 335
Shuey, G. A., work of 31
Slauson, Cal., ground water near 340
Slope method, description of 18
Slow Creek:
discharge 338
Smartsville, Cal.,
Yuba River near:
description 212
discharge 213
discharge, daily 215
discharge, monthly 216
gage heights 214
Soledad, Cal.,
Arroyo Seco near:
description 146
discharge 147
discharge, monthly 149
gage heights 147–148
rating table 148
South Pacific Ocean drainage:
description 100
miscellaneous measurements 335–336
stream flow 101–149
Southern California, fluctuations of ground water in 338–348
wells in, location of, map showing 338
Spadra, Cal., ground water near 344
Sprague River, Oreg.,
Williamson River at and near:
discharge 337
Sprague River near—
Yainax Agency, Oreg.:
discharge 337
Spring River at—
Strattons Camp, Oreg.:
discharge 337
Stanislaus Electric Power Co.'s plant, view of 250
Stanislaus River at—
Knights Ferry, Cal.:
description 282
discharge 283
discharge, monthly 285
gage heights 283–284
rating tables 284–285
Stanislaus River basin:
description 280–281
gaging station 281
stream flow 282–288
Stanislaus Water Co.'s canal at—
Knights Ferry, Cal.:
description 285–286
discharge 286
discharge, monthly 288
gage heights 286–287
rating table 287

Page.
Stevens, G. C., work of 31
Stevens, J. C., work of 31
Stevens canal at—
Citrus, Cal.:
discharge 334
Steward, W. G., work of 31
Stony Creek, Cal.,
Grindstone Creek near:
discharge 336
Stony Creek basin:
description 168–169
gaging stations 169
stream flow 169–175
Stony Creek at or near—
Fruto, Cal.:
description 169–170
discharge 170
discharge, monthly 172–173
gage heights 170–171
rating tables 171–172
view 168
Rockville, Cal.:
discharge 336
Strattons Camp, Oreg.,
Spring River at:
discharge 337
Stream measurements, accuracy of 29
data of, use of 29–30
methods of 18–23
Sunnyside, Cal., ground water near 340
Sunny Slope, Cal., ground water at 342
Swamps, drainage of, stream flow and 11–12
Sweetwater reservoir:
run-off 106
Sweetwater River basin:
description 105
stream flow 106–109
Sweetwater River near—
Descanso, Cal.:
description 106
discharge 107
discharge, monthly 109
gage heights 107–108
Symmes Creek near—
Independence, Cal.:
discharge 334

T.

Tables, explanation of 17–18
Taboose Creek near—
Tibbetts, Cal.:
description 74
discharge 75
discharge, monthly 76–77
gage heights 75–76
upper road crossing:
discharge 333
Tecumseh Creek near—
Klamath Agency, Oreg.:
discharge 337
Temecula River near—
Temecula, Cal.:
discharge 335
Tenaya Creek in—
Yosemite Valley, Cal.:
description 262–263
discharge 263
Tenaya Creek in— Page.
Yosemite Valley, Cal.—Continued.
discharge, monthly 265
gage heights 263–264
rating tables 264
Terms, definition of 15–16
Thebe, Cal.,
Bairs Creek near:
description 88
discharge 88
discharge, monthly 89
George Creek near:
description 89
discharge 89
discharge, monthly 90
Shepard Creek near:
description 87
discharge 87
discharge, monthly 88
Thibaut Creek near—
Independence, Cal.:
description 82
discharge 82
Thompson ranch, Cal.,
Owens River at:
discharge 333
Threemile Creek:
discharge 337
Three Rivers, Cal.,
Kaweah River near:
description 247
discharge 247
discharge, monthly 249
discharge curves for, chart showing 25
gage heights 248
rating table 249
Tia Juana River basin:
description 101
gaging stations 102
stream flow 102–104
Tibbetts, Cal.,
Goodale Creek near:
description 77
discharge 77
discharge, monthly 79
gage heights 78
Taboose Creek near:
description 74
discharge 75
discharge, monthly 76–77
gage heights 75–76
Tinemaha, Cal.,
Birch Creek near:
description 70
discharge 70
discharge, monthly 71–72
gage heights 70–71
Owens River near:
description 55
discharge 56
discharge, monthly 58
gage heights 57
rating tables 58
Tinemaha Creek near:
description 72
discharge 72
discharge, monthly 74
gage heights 73

Page.
Tulare Lake, Cal.:
description 233–235
gage heights 235–237
Tulare Lake basin:
description 233
Tule Lake near—
Merrill, Oreg.:
description 327
gage heights 328
Tule River basin:
description 241–242
gaging station 242
stream flow 243–245
Tule River near—
Portersville, Cal.:
description 243
discharge 243
discharge, monthly 245
gage heights 243–244
rating table 244
Tuolumne River at—
Lagrange, Cal.:
description 269–270
discharge 270
discharge, monthly 273
gage heights 270–271
rating tables 272
Lagrange dam, Cal.:
description 269–270
gage heights 271
rating table 273
view 270
Tuolumne River basin:
description 267–269
gaging stations 269
stream flow 269–280
Turlock canal near—
Lagrange, Cal.:
description 277
discharge 277
discharge, monthly 279
gage heights 277–278
rating table 278
Tuttle Creek near—
Lone Pine, Cal.:
description 92
discharge 92–93
discharge, monthly 94
gage heights 93–94

U.

Upper Klamath Lake basin:
miscellaneous measurements 337
Upper Klamath Lake near—
Klamath Falls, Oreg.:
description 302
gage heights 302–303

V.

Van Trent, Cal.,
Bear River at:
description 217
discharge 217
discharge, monthly 220
gage heights 218
rating tables 219
Velocity method, description of 19–23
Vineland, Cal., ground water at 344

W. Page.
Warner's ranch, Cal.,
San Luis Rey River at:
discharge 335
Waterman Canyon near—
Arrowhead Hotel:
discharge 335
Water power, stream flow and 11
Water supply, stream flow and 11
Weir method, description of 19
West Twin Creek. *See* Waterman Canyon.
Whittier, Cal., ground water near 342
Wilbur ditch:
discharge 131
Williams canal at—
Williams ranch:
discharge 334
Williamson River at or near—
Chillaquin Bridge, Oreg.:
discharge 337
Klamath Agency, Oreg.:
description 316–317
discharge 317
discharge, monthly 319
gage heights 317
rating table 318
Sprague River, Oreg.:
discharge 337
Willow Creek at—
Brownell, Cal.:
discharge 338
Winchester, Cal., ground water at and near 347
Winters, Cal.,
Puta Creek at:
description 184
discharge 184
discharge, monthly 187
gage heights 185
rating tables 186
Wood, B. D., work of 31
Wood River at:
Fort Klamath, Oreg.:
discharge 337
Woods Bridge, Cal.,
Klamath River at:
discharge 336
Work, division of 31

Y.

Yainax Agency, Oreg.,
Sprague River near:
discharge 337
Yolo, Cal.,
Cache Creek near:
description 179–180
discharge 180
discharge, monthly 182
gage heights 180–181
rating tables 181–182
Yosemite Valley, Cal.,
Merced River in:
description 256–257
discharge 257
discharge, monthly 259
gage heights 257–258
rating table 258

Yosemite Valley, Cal.—Continued. Page.
Tenaya Creek in:
description 262–263
discharge 263
discharge, monthly 265
gage heights 263–264
rating tables 264
Yosemite Creek in:
description 265–266
discharge 266
gage heights 266–267
Yreka, Cal.,
Shasta River near:
discharge 336
Yuba River basin:
description 210–212
gaging station 212
stream flow 212–216
Yuba River near— Page.
Smartsville, Cal.:
description 212
discharge 213
discharge, daily 215
discharge, monthly 216
gage heights 214
Yuma, Ariz.,
Colorado River at:
description 33–34
discharge 34–35
discharge, daily 37
discharge, monthly 38
gage heights 36

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 252

SURFACE WATER SUPPLY OF THE UNITED STATES

1907-8

PART XII. NORTH PACIFIC COAST

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

J. C. STEVENS AND F. F. HENSHAW

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

CONTENTS.

	Page.
Introduction	9
Authority for investigations	9
Scope of investigations	10
Purposes of the work	11
Publications	12
Definition of terms	15
Convenient equivalents	16
Explanation of tables	17
Field methods of measuring stream flow	18
Office methods of computing and studying discharge and run-off	23
Accuracy and reliability of field data and comparative results	27
Use of the data	28
Cooperation and acknowledgments	29
Division of work	31
Rogue River drainage basin	31
Description	31
North Fork of Rogue River at Prospect, Oreg	33
Rogue River near Tolo, Oreg	35
Little Butte Creek, near Eagle Point, Oreg	38
Bear Creek at Talent, Oreg	40
Applegate Creek at Murphy, Oreg	43
Miscellaneous measurements	46
Umpqua River drainage basin	47
Description	47
South Fork of Umpqua River near Brockway, Oreg	48
Umpqua River near Elkton, Oreg	50
North Fork of Umpqua River near Oakcreek and Winchester, Oreg	53
Mill Creek near Ash, Oreg	56
Siletz River drainage basin	58
Description	58
Siletz River at Siletz, Oreg	58
Columbia River drainage basin	61
Description	61
Columbia River	66
Columbia River near Pasco, Wash	66
Columbia River at The Dalles, Oreg	67
Miscellaneous measurements	80
Clark Fork drainage basin	81
Description	81
Clark Fork at Missoula, Mont	83
Clark Fork at Priest River, Idaho, and Newport, Wash	85
Bitterroot River near Grantsdale, Mont	90
Flathead River near Polson, Mont	92
Stillwater River near Kalispel, Mont	95
Little Bitterroot Creek near Dayton, Mont	96
Crow Creek near Ronan, Mont	97

Columbia River drainage basin—Continued.
Clark Fork drainage basin—Continued. Page.
Mud Creek near Ronan, Mont. 100
Mission Creek near St. Ignatius, Mont. 101
Dry Creek near St. Ignatius, Mont. 105
Post Creek near St. Ignatius, Mont. 107
Jocko River near Jocko, Mont. 110
Jocko River at Ravalli, Mont. 111
Big Knife Creek near Jocko, Mont. 114
Agency Creek near Jocko, Mont. 114
Finley Creek near Jocko, Mont. 115
East Finley Creek near Jocko, Mont. 115
Indian ditch near Jocko, Mont. 116
Valley Creek near Ravalli, Mont. 116
Miscellaneous measurements. 117
Spokane River drainage basin. 117
Description. 117
Spokane River at Spokane, Wash. 117
Okanogan River drainage basin. 120
Description. 120
Johnson Creek near Riverside, Wash. 121
Salmon Creek near Malott, Wash. 122
Miscellaneous measurements. 125
Methow River drainage basin. 125
Methow River at Pateros, Wash. 125
Miscellaneous measurement. 128
Chelan River drainage basin. 128
Chelan River at Chelan, Wash. 128
Wenatchee River drainage basin. 130
Wenatchee River at Cashmere, Wash. 130
Miscellaneous measurement. 133
Yakima River drainage basin. 133
Description. 133
Lake Keechelus near Martin, Wash. 135
Yakima River near Martin, Wash. 137
Yakima River at Clealum, Wash. 140
Yakima River at Umtanum, Wash. 143
Yakima River near Yakima, Wash. 146
Yakima River near Wapato, Wash. 150
Yakima River at Kiona, Wash. 152
Yakima River near Richland, Wash. 155
Kachess Lake near Easton, Wash. 156
Kachess River near Easton, Wash. 158
North Fork of Clealum River at Galena, Wash. 160
Clealum Lake near Roslyn, Wash. 161
Clealum River near Roslyn, Wash. 164
Naches River near Nile, Wash. 167
Naches River near North Yakima, Wash. 171
Tieton River at McAllister Meadows, near Naches, Wash. 175
Tieton River at headworks of Tieton canal near Naches, Wash. 177
Tieton River near Naches, Wash. 180
North Fork of Atanum Creek near Tampico, Wash. 184
Atanum Creek at Narrows, near Tampico, Wash. 186
Atanum Creek near Yakima, Wash. 187

Columbia River drainage basin—Continued.
Yakima River drainage basin—Continued. Page.
South Fork of Atanum Creek near Tampico, Wash. 189
Toppenish Creek near Toppenish, Wash. 191
Satus Creek near Toppenish, Wash. 192
Canals in Yakima valley. 192
New Reservation canal near Yakima, Wash. 192
Old Reservation canal near Wapato, Wash. 197
Sunnyside canal near Wapato, Wash. 201
Kiona canal near Kiona, Wash. 205
Miscellaneous measurements. 205
Evaporation station at Lake Kachess, Wash. 207
Evaporation station at Zillah, Wash. 208
Snake River drainage basin. 209
Description. 209
Snake River. 211
Snake River near Blackfoot, Idaho. 211
Snake River at Neeley, Idaho. 212
Snake River near Minidoka, Idaho. 215
South Fork of Snake River basin. 218
Jackson Lake near Moran, Wyo. 218
South Fork of Snake River at Moran, Wyo. 218
South Fork of Snake River near Lyon, Idaho. 220
North Fork of Snake River basin. 223
North Fork of Snake River near Ora, Idaho. 223
Fall River at Fremont, Idaho. 226
Teton River near St. Anthony, Idaho. 228
Blackfoot River basin. 231
Description. 231
Blackfoot River near Rossfork, Idaho. 231
Blackfoot River near Presto, Idaho. 231
Big Lost River near Chilly, Idaho. 235
Big Wood River near Shoshone, Idaho. 237
Succor Creek near Homedale, Idaho. 239
Owyhee River basin. 241
Description. 241
Owyhee River at Owyhee, Oreg. 242
Boise River basin. 245
Description. 245
Boise River near Highland, Idaho. 245
Seepage investigations on Boise River. 248
Payette River basin. 252
Description. 252
North Fork of Payette River at Lardo, Idaho. 253
Payette River near Horseshoe Bend, Idaho. 253
Malheur River basin. 256
Description. 256
Malheur River at Vale, Oreg. 257
Middle Fork of Malheur River at Riverside, Oreg. 259
Bully Creek near Vale, Oreg. 260
Powder River basin. 261
Description. 261
Powder River at Salisbury, Oreg. 262
Miscellaneous measurements. 265

Columbia River drainage basin—Continued.
Snake River drainage basin—Continued. Page.
Grande Ronde River basin 265
Description 265
Grande Ronde River at Hilgard, Oreg 267
Grande Ronde River at Elgin, Oreg 270
Grande Ronde River at Zindel, Wash 273
Catherine Creek near Union, Oreg 275
Wallowa River near Joseph, Oreg 275
Wallowa River near Wallowa, Oreg 277
Wallowa River near Elgin, Oreg 278
Palouse River basin 280
Description 280
Palouse River at Hooper, Wash 281
Miscellaneous measurements in Snake River basin 284
Walla Walla River drainage basin 285
Description 285
Walla Walla River near Milton, Oreg 285
South Fork of Walla Walla River near Milton, Oreg 287
Umatilla River drainage basin 290
Description 290
Umatilla River at Gibbon, Oreg 291
Umatilla River at Yoakum, Oreg 293
Umatilla River near Umatilla, Oreg 296
Miscellaneous measurements 299
John Day River drainage basin 299
Description 299
John Day River near Dayville, Oreg 300
John Day River at McDonald, Oreg 301
South Fork of John Day River at Dayville, Oreg 303
Miscellaneous measurements 304
Deschutes River drainage basin 304
Description 304
Deschutes River at Allen's ranch, near Lava, Oreg 306
Deschutes River at West's ranch, near Lava, Oreg 309
Deschutes River at Bend, Oreg 312
Deschutes River near Biggs, Oreg 313
East Fork of Deschutes River at Crescent, Oreg 316
West Fork of Deschutes River near Lava, Oreg 318
Tumalo Creek near Laidlaw and Bend, Oreg 319
Lewis Creek near Laidlaw, Oreg 324
Squaw Creek near Sisters, Oreg 325
Crooked River near Post, Oreg 327
Crooked River near Prineville, Oreg 328
Ochoco Creek and Elliot ditch near Prineville, Oreg 328
Metolius River near Sisters, Oreg 329
Canals and ditches in Deschutes River basin 330
Central Oregon and Pilot Butte canals near Bend, Oreg 330
Wimer canal near Laidlaw, Oreg 334
Columbia Southern canal near Laidlaw, Oreg 336
Miscellaneous measurements 338
Hood River drainage basin 339
Description 339
Hood River at Winans, Oreg 339

Columbia River drainage basin—Continued. Page.
Sandy River drainage basin 341
Description 341
Sandy River at Salmon, Oreg 342
Bull Run River near Bull Run, Oreg 343
Miscellaneous measurements 346
Willamette River drainage basin 346
Description 346
Middle Fork of Willamette River at Jasper, Oreg 348
Willamette River at Albany, Oreg 352
Coast Fork of Willamette River near Goshen, Oreg 358
McKenzie River near Springfield, Oreg 361
North Fork of Santiam River at Detroit, Oreg 364
North Fork of Santiam River at Mehama, Oreg 366
Santiam River at Jefferson, Oreg 367
Marion Fork of Santiam River at Marion Lake, near Detroit, Oreg 368
Puzzle Creek near Detroit, Oreg 369
Permelia Creek near Detroit, Oreg 370
Whitewater Creek near Detroit, Oreg 371
South Fork of Santiam River at Waterloo, Oreg 372
Luckiamute River near Suver, Oreg 373
South Fork of Yamhill River at Sheridan, Oreg 376
Yamhill River at La Fayette, Oreg 379
Molalla River near Molalla, Oreg 380
Clackamas River at Estacada, Oreg 383
Clackamas River near Barton, Oreg 385
Miscellaneous measurements 388
Puget Sound drainage basin 389
Description 389
Cedar River near Ravensdale, Wash 390
Summary of mean discharge per square mile 393
Index 399

ILLUSTRATIONS.

Page.
PLATE I. *A*, Current-meter station at Los Angeles, Cal.; *B*, Bridge station and cross section of stream, illustrative of 0.2 and 0.8 depth method 20
II. Price penta-recording current meters 22
III. *A*, Dam and power plant on Rogue River near Tolo, Oreg.; *B*, Cultivated land under Kennewick canal, 2 miles south of Kennewick, Wash 36
IV. Discharge curve for Columbia River at The Dalles, Oreg 68
V. Glaciers (in August) at the headwaters of South Fork of Tieton River, Washington 168
VI. Sunnyside canal heading, Yakima project, Washington 202
VII. *A*, Furnas ranch, near Hermiston, Oreg., Umatilla project; *B*, Minidoka dam and regulating devices 290
VIII. *A*, Twin Falls on North Fork of Santiam River, just below outlet of Marion Lake, Oreg.; *B*, Gatch Falls on North Fork of Santiam River, 3 miles below Twin Falls 364
IX. Hydro-electric plant on Puyallup River near Electron, Wash 388

SURFACE WATER SUPPLY OF THE NORTH PACIFIC COAST, 1907-8.

By J. C. Stevens and F. F. Henshaw.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

> Provided that this officer [the Director] shall have the direction of the Geological Survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

> For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited to that which can be provided with the appropriations available. The field covered and the character of the work are believed to be the best that could be accomplished under the controlling conditions. It would undoubtedly be of more scientific importance and ultimately of more practical value if the money now applied to wide areas were concentrated on a few small basins. Such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be maintained during a period of years sufficient to cover all stages, in order that within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum may be determined. The length of such a period manifestly varies for different streams and can not be absolutely determined. Experience has shown that the records should cover from five to ten years, or for some streams twenty years or more, the limit being determined by the relative importance of the stream and the interdependence of the results and other long-time records on adjacent streams.

In the performance of this work the Geological Survey endeavors to approach as nearly as possible the highest degree of precision which a rational expenditure of time and a judicious expenditure of a small amount of money will allow. In all engineering work there is a point of refinement beyond which it is needless and wasteful to proceed, and this principle applies with especial force to stream-flow measurements. It is confidently believed that with some unavoidable exceptions the stream-flow data presented in the publications of the Survey are sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of many stations. All persons are cautioned to exercise the greatest care in the utilization of such incomplete records.

Records of varying lengths have been obtained at about 1,400 different points in the United States, and in addition the surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1907 and 1908 regular gaging stations were maintained by the Survey and cooperating organizations at about 740 points in the United States, and in addition numerous miscellaneous measurements were made. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country.

These data will be made available in the regular surface water-supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

Among the purposes for which the results contained in this volume are requisite are navigation, irrigation, domestic water supply, water power, swamp and overflow land drainage, and flood prevention. The demands of all these interests are immediate.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $42,000,000 on federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system is based absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are of first importance in the redemption of the lands, as well as constituting an insurance of federal and private investments.

Domestic water supply.—The highest use of water is that of domestic supply, and while the federal interest in this aspect of the matter is less direct than in the aspects already named, this use of water nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The time is rapidly approaching when the development of the water power of the country will be an economic necessity. Our stock of coal is being rapidly depleted and the cost of steam power is increasing accordingly. Industry will cease its growth if cheap power is not available, and in that event the United States as a nation will cease to progress. Water power is the only avenue now open. When the electric transmission of power was accomplished, the relation of our water powers to national economy changed entirely. Previous to the day of electric transmission the importance of a water power was largely confined to the locality at which it was generated, but it has now become a public utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available is dependent on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worthless, or of precarious value, by reason of overflow and swamp condi-

tions. When this land is drained it becomes exceedingly productive and its value increases many fold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the first consideration in connection with drainage projects. If, by the drainage of a large area into any particular channel, that channel becomes so gorged with water that overflow conditions are created in places not previously subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States exceeds $100,000,000 annually and in the year 1908 the aggregate damage, based on reliable data, approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications has varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1907 and 1908. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1907–8.

Part.	No.	Title.	Part.	No.	Title.
I	241	North Atlantic coast.	VI	246	Missouri River basin.
II	242	South Atlantic coast and eastern Gulf of Mexico.	VII	247	Lower Mississippi River basin.
III	243	Ohio River basin.	VIII	248	Western Gulf of Mexico.
IV	244	St. Lawrence River basin.	IX	249	Colorado River basin.
V	245	Upper Mississippi River and Hudson Bay basins.	X	250	Great Basin.
			XI	251	California.
			XII	252	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the

United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive and dates also are inclusive so far as the data are available.

Stream-flow data in reports of the United States Geological Survey.

[Ann.=Annual Report; B.=Bulletin; W. S.=Water-Supply Paper.]

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B. 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	do	1903.
W. S. 124 to 135	do	1904.
W. S. 165 to 178	do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1908. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1908.

	1899.[a]	1900.[b]	1901.	1902.	1903.	1904.	1905.	1906.	1907–8.
Atlantic coast and eastern Gulf of Mexico:									
New England rivers	35	47	65, 75	82	97	124	165	201	241
Hudson River to Delaware River, inclusive	35	47, (48)	65, 75	82	97	125	166	202	241
Susquehanna River to York River, inclusive	35	48	65, 75	82	97	126	167	203	241
James River to Yadkin River, inclusive	(35), 36	48	65, 75	(82), 83	(97), 98	126	167	203	242
Santee River to Pearl River, inclusive	36	48	65, 75	83	98	127	168	204	242
St. Lawrence River	36	49	65, 75	(82), 83	97	129	170	206	244
Hudson Bay	.....	.....	66, 75	85	100	130	171	207	245
Mississippi River:									
Ohio River	36	48, (49)	65, 75	83	98	128	169	205	243
Upper Mississippi River	36	49	65, 75	83	98, (99)	128, (130)	171	207	245
Missouri River	(36), 37	49, (50)	66, 75	84	99	130, (131)	172	208	246
Lower Mississippi River	37	50	(65), 66, 75	(83), 84	(98), 99	(128), 131	(169), 173	(205), 209	247
Western Gulf of Mexico	37	50	66, 75	84	99	132	174	210	248
Pacific coast and Great Basin:									
Colorado River	(37), 38	50	66, 75	85	100	133, (134)	175, (177)	211, (213)	249, (251)
Great Basin	38, (39)	51	66, 75	85	100	133, (134)	176, (177)	212, (213)	250, (251)
South Pacific coast to Klamath River, inclusive	(38), 39	51	66, 75	85	100	134	177	213	251
North Pacific coast	38	51	66, 75	85	100	135	(177), 178	214	252

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	All stations in Colorado and Great Basin drainages lying in California repeated.
	Great Basin	

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the

basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the mouth of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated above, and in the records for large lakes, where it is often clearer to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the rate of discharge of water that passes through an orifice 1 inch square under a head which varies locally. It is commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.

$1\frac{1}{3}$ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, rating table, table of monthly and yearly discharges, and run-off. For stations located at weirs or dams the gage-height and rating tables are omitted and a table of daily discharge is substituted. For stations where the flow is computed by shifting-channel methods, a table of daily discharge is given in place of rating tables, which are not used in these methods of computation.

In addition to statements regarding the location and installation of current-meter stations the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also full information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with suitable footnotes. The rating is not applicable for such periods unless the proper correction to the gage heights is known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which the rating tables and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is published to enable engineers to determine the daily discharge by its application to the table of gage heights or to check results in the table of monthly discharge.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the period when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 15, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir or dam; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions. It is seldom used by the United States Geological Survey. For full information regarding the method the reader is referred to the various text-books on hydraulics.

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of sharp-crested and broad-crested weirs within the limits for which

accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, crest which is not level, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general, records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current-meter gaging stations under unobstructed channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.

The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200[a]) and in the various text-books on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The editions of both of these water-supply papers are practically exhausted. They can, however, be consulted at most of the larger libraries of the country or they can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 20 cents for No. 180 and 35 cents for No. 200. Remittances must be made by postal money order, express order, or New York draft.

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently but which do not cause a variation of more than about 5 per cent in the discharge curves from year to year; and (4) those with constantly shifting beds. In determining the daily flow different office methods are necessary for each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in

[a] Water-Supply Paper 200 is a revision of No. 150, the edition of which is exhausted.

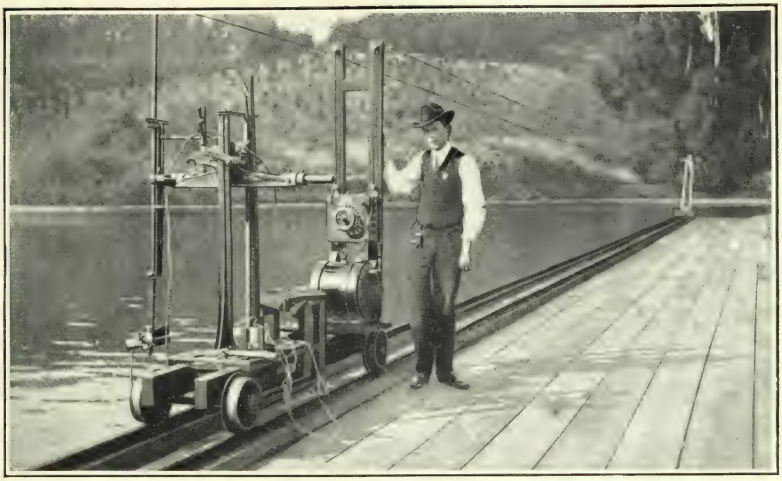
order that the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years, unless funds are available to cover all changes in conditions of flow. A straight, smooth section without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the cost of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 2 to 5 per cent or less of the total width, will within reasonable limits yield better results for a given outlay of money than semipermanent or shifting sections with smooth, uniform current. So far as possible, stations are located where the banks are high and not subject to overflow at high stages, and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

In making a measurement with a current meter a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *B*.) These points are spaced equally for those parts of the section where the flow is uniform and smooth and are spaced unequally for other parts according to the discretion and judgment of the engineer. In general the points should not be spaced farther apart than 5 per cent of the distance between piers, nor farther apart than the approximate mean depth at the time of measurement.

The measuring points divide the total cross section into elementary strips at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total



A. CURRENT-METER STATION AT LOS ANGELES, CAL.

B. BRIDGE STATION AND CROSS SECTION OF STREAM.

Illustrating 0.2 and 0.8 depth method.

discharge of the stream. (For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.)

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method with its various modifications of surface, subsurface, and tube or rod floats is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions, where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity. For further information regarding this method the reader is referred to Water-Supply Paper 95 and to the various text-books covering the general subject of stream flow.

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions. Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations. On the sides the same type of meter is shown equipped for wading measurements to record by the acoustic method on the left and by the electric method on the right. Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The number of revolutions is indicated electrically. The rating, or relation between the velocity of the moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. (See Pl. I, *A*.) From these data a rating table is prepared which

gives the velocity per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

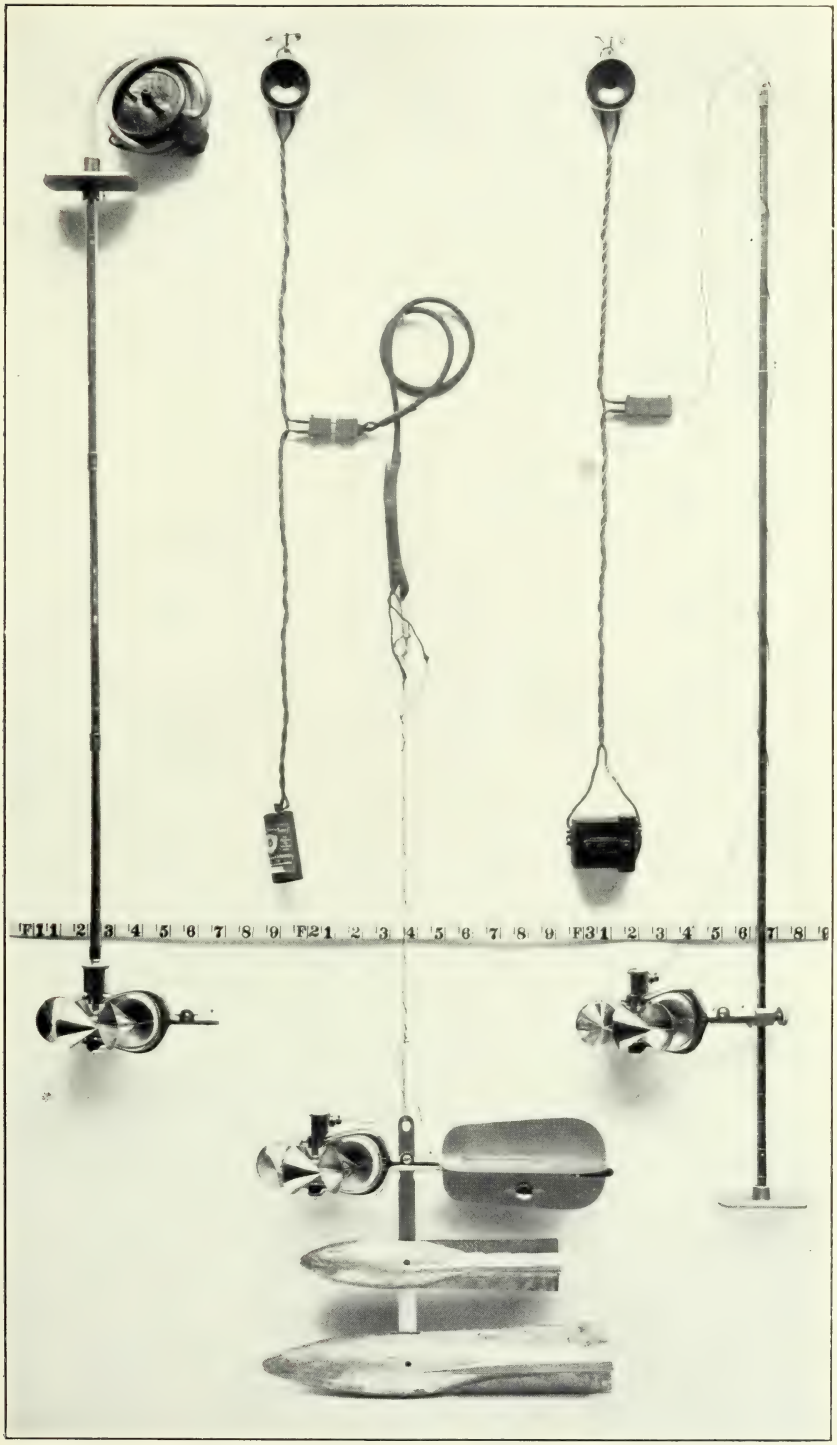
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I, *B*.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined or must be assumed.

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average



PRICE PENTA-RECORDING CURRENT METERS.

coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be in general from about 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept in the correct position for the other methods.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper 187.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and

from these applications the tables of monthly discharge and run-off are computed.

Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 19.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are more or less generally parabolic in form. In many cases curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every published rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating as stated in the footnote of each table is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean-discharge curve, and the rating developed from that curve represents a very high degree of accuracy. For illustrative example of a station of this type see Water-Supply Paper 241 and Plate IV.

Class 2 is confined mainly to stations on rough mountainous streams with steep slopes. The beds of such streams are as a rule comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge

measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow. For illustrative example of a station of this type see Water-Supply Paper 246.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if, after a change caused by high stage, a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to their ordinates or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semipermanent and shifting channels. It is not absolutely correct, but with few exceptions answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is of course fundamentally due to change in the channel caused by cut, or fill, or both, at and near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel, which either

reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect, and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky controlling point the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another, and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity, which tend to produce a new parallel discharge curve, may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class. For illustration of a station of this class see Water-Supply Paper 242, page 23.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is

assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. For illustrative example of a station of this type, showing the Bolster method of determining the daily discharge graphically, see Water-Supply Papers 247 and 249.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as is feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the monthly discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions wherever available, daily records of temperature and precipitation obtained from the United States Weather Bureau climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all, and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are as a rule included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is

much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions the observers perform their work honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the rating tables and an accuracy column is inserted in the monthly discharge table. In the rating tables "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the Survey engineers. This is done to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and

published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for five or ten year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates. This is particularly true of the maximum and minimum figures, which in the very nature of the method of collecting these data are liable to large errors. The maximum value should be increased considerably for many stations in considering designs for spillways, and the minimum value should be considered for a group of, say, seven days and not for one day.

The rating table, provided the engineer accepts it, is published primarily to allow him to apply it directly to the daily gage heights and rearrange the daily discharges in order of magnitude or by some other method.

COOPERATION AND ACKNOWLEDGMENTS.

The work in Oregon has been done in cooperation with the State. The legislature of 1905 passed an act providing an annual appropriation of $2,500 contingent upon the United States Geological Survey allotting an equal amount to be expended within the State for the investigation of its water resources.

The act of 1905 makes the state engineer the agent of the State in this cooperation, and each year a contract is entered into between the state engineer and the Director of the Geological Survey. The principal features of the contract are as follows:

1. The United States Geological Survey retains direct supervision of the field work and the preparation of the data for publication.

2. All the material collected—field notes, maps, etc.—are open at any time to the inspection of the state engineer, and if they are not entirely satisfactory the agreement can be terminated at any time.

3. The salaries of classified employees and cost of nonexpendable equipment is paid from the government fund, while traveling expenses, salary and expenses of field assistants, and cost of expendable supplies are paid from the state fund. In this manner practically the entire amount of the State's appropriation is expended within the State.

4. The cost of publication is borne entirely by the Geological Survey.

To secure efficiency, no better scheme than cooperative investigations of this nature can be devised. The State is the chief beneficiary, for its interest in procuring a thorough knowledge of its resources is paramount. At a very moderate cost for field work it can take advantage of an organization already trained in the collection of the data and obtain the published results without additional expense.

Unfortunately the amount appropriated by the State is altogether inadequate to satisfy the demand for water-supply data. The United States Geological Survey, therefore, has found it necessary to expend more than treble the amount required to meet the State's appropriation. The United States Reclamation Service, which is perhaps the heaviest investor in the development of the State's resources, has been so handicapped in its work for lack of water-supply data that it has expended from its own fund considerable money for investigations of this nature. Interbureau agreements have been reached whereby the greater part of the work for the Reclamation Service is carried on by the Geological Survey through its organized force, and the actual cost thereof refunded. For the calendar year 1908 there has been expended by the Geological Survey from government and state funds a total of $10,810.79, distributed as follows:

Expenditures for hydrographic work, Oregon, calendar year 1908.

United States Geological Survey	$4,796.61
United States Reclamation Service	3,253.89
Office of Indian Affairs	260.29
Total government funds	8,310.79
Appropriation by State of Oregon	2,500.00

Many inquiries have been made as to the cost of hydrographic work. The following data will be of interest:

Cost of hydrographic work in Oregon, calendar year 1908.

Total expenditure for maintenance of river stations and allied investigations	$10,810.79
Number of stations maintained	78
Cost per station	$138.59
Number of stream gagings made	328
Cost per gaging	$32.96

Distribution of expenditures.

	Per cent.
Field services	32
Office services	20
Traveling expenses	21
Supplies and equipment	17
Lost time (Sundays, holidays, etc)	6
Rent and storage	2
General	2

Special acknowledgments are due to John H. Lewis, state engineer of Oregon, for the very efficient manner in which he has represented the State in the cooperative investigations.

Acknowledgments are due to the engineers and employees of the United States Reclamation Service for assistance in the maintenance of stations and for the freest use of data which were collected exclusively for them and for which they have paid.

Acknowledgments are also due to the officers of the United States Weather Bureau and to the United States Engineer Corps for climatologic and hydrographic data, also to a number of irrigation and power companies, and to many individuals for cooperation in the maintenance of stations and for other assistance and suggestions in the collection and preparation for publication of the data herein contained.

DIVISION OF WORK.

The field data in the Columbia River basin in Oregon and Washington, the Puget Sound drainage area, and the Pacific Ocean drainage area in Oregon were collected under the direction of J. C. Stevens, district engineer, assisted by H. D. McGlashan, L. R. Allen, C. E. Ellsworth, Howard Kimble, and R. B. Post.

The field data for the Snake River drainage area in Idaho has been collected under the direction of E. C. La Rue, district engineer, assisted by A. D. Williams and E. A. Porter.

The field data for the Clark Fork drainage area in Montana have been collected under the direction of J. E. Stewart, district engineer, assisted by A. F. Huch and Raymond Richards.

The ratings, special estimates, and analyses of completed data were made by J. C. Stevens, E. C. La Rue, J. E. Stewart, and F. F. Henshaw. The computations and final preparation of the completed data for publication were made under the direction of F. F. Henshaw, assistant engineer, assisted by G. C. Stevens, G. L. Parker, H. D. Padgett, R. C. Rice, and M. I. Walters. The entire manuscript has been edited by Mrs. B. D. Wood.

ROGUE RIVER DRAINAGE BASIN.

DESCRIPTION.

Rogue River drains the southwestern corner of the State of Oregon, its basin extending from the extreme western part of Klamath County across Jackson and Josephine counties, and including the northern half of Curry County. On its north are the Rogue River Mountains and on the east are the Cascades, while in the southern part of the area is a spur of the Siskiyou Mountains. In all the basin comprises 5,080 square miles.

The river is formed by three principal forks—the North, Middle, and South—which rise among the peaks of the Cascade Range and unite near Prospect, in Jackson County. From this point the Rogue winds in a general westerly direction to the ocean, which it en ers near the town of Gold Beach, in Curry County. In the lower half of its course the stream hugs closely the base of the Rogue River Range, and its principal tributaries are from the south, as is shown by the following table:

Principal tributaries of Rogue River.

From the north and west.	From the east and south.
North Fork.	Middle Fork.
Elk Creek.	South Fork.
Stewart Creek.	Big Butte Creek (drainage area, 268 square miles).
Evans Creek.	Little Butte Creek (drainage area, 361 square miles).
Leland Creek.	Bear Creek (Stewart Creek) (drainage area, 380 square miles).
	Applegate Creek (drainage area, 606 square miles).
	Illinois River.

The North Fork, or main stream, derives its water from springs, probably supplied from Crater Lake, which lies to the east in the center of Crater Lake Natural Park at an elevation of 6,240 feet above sea level. This lake occupies the crater of an ancient volcanic mountain to which the name Mount Mazama has been applied. The lake has no visible outlet[a] nor any other reaching the surface within a few miles. The walls inclosing the lake are made up of alternating sheets of lava, dipping away from the lake practically in all directions, and are so porous as to afford an easy passage for much water. Springs are abundant and remarkable in size. Little and Big Butte creeks drain the southern portion of the Cascade Forest Reserve. Bear Creek, formerly called Stewart Creek, drains the famous fruit section of Rogue River valley; Applegate Creek drains the Siskiyou Mountains; and Illinois River the territory to the south of the main stream near the coast.

The drainage area is in general mountainous, elevations ranging from sea level at Gold Beach to 9,760 feet at the summit of Mount McLaughlin (formerly known as Mount Pitt)—a snow-capped peak dividing the drainage of Big Butte and Little Butte creeks. The general elevation of the mountain range at the headwaters of the Rogue is 6,000 feet. Prospect is 3,000 feet, Ashland is 1,938 feet, and Grants Pass 956 feet above sea level.

The area is almost completely timbered, but the stand is not so heavy as on the area to the north drained by Umpqua River, as the

[a] Diller, J. S., Geology of Crater Lake Natural Park: Prof. Paper U. S. Geol. Survey No. 3, 1902, p. 60.

precipitation is lighter. The mean annual rainfall at Gold Beach is 86 inches, at Grants Pass 33, at Ashland 27, on the headwaters of Illinois River 70, and at Crater Lake 100 inches. At the headwaters of the stream the greater part of the precipitation is rainfall during the winter months. As is usual in regions where the precipitation is sufficient for the production of crops without irrigation, development along this line is inconsiderable. Fish Lake ditch, which diverts water from Little Butte Creek, is the largest in operation. A number of little ditches are used to irrigate the narrow valley lands contiguous to the small streams. In this manner Ashland, Wagner, and Applegate creeks are largely appropriated for irrigation. It is realized, however, that the agricultural resources of this section of the country will not be utilized in the most economic manner until irrigation is practiced extensively. The valley lands in the vicinity of Grants Pass along Bear Creek are particularly adapted to fruit culture, and the Rogue River valley has become justly famous for the excellent quality of apples, pears, and other fruits raised there.

The streams of this area, like others draining the Cascade Mountains, afford wonderful possibilities for water-power development. At present the only important plants are those of the Rogue River Electric Company at Gold Ray and at Prospect.

Stream measurements in this basin were begun in August, 1905. For the three and half years the highest run-off values are shown by the records for 1907. It is probable that the lowest values would have been found in 1905 if records for that year had been complete.

The following gaging stations have been maintained in this river basin:

Rogue River near Tolo (1905 to 1908).
North Fork of Rogue River at Prospect (1907 and 1908).
Little Butte Creek near Eagle Point (1907 and 1908).
Bear Creek at Talent (1907 and 1908).
Applegate Creek at Murphy (1907 and 1908).
Rogue River near Galice (1907).

NORTH FORK OF ROGUE RIVER AT PROSPECT, OREG.

This station was established July 17, 1907, just above the Rogue River Electric Company's dam one-half mile above Prospect, 5 miles above the junction with the South Fork, and at the head of Rogue River gorge.

The fall of the river through this gorge is to be utilized by the company for development of water power. The data are valuable chiefly in connection with water-power development, but they furnish also some very useful information concerning the run-off from forested areas under the climatic conditions which exist in the southern portion of the Cascade Range.

No equipment has yet been installed for making measurements during high water, and at low water the only point available is in a very narrow canyon, where the water is extremely turbulent and the velocities are most irregular. The gage located above the dam was read daily from July 17 to October 10, 1907, and once or twice a week during the first half of 1908, but the daily ratings during 1908 were made on an auxiliary gage at the observer's house. No estimates of flow are possible with the data at hand, but it is hoped that a permanent rating curve can later be developed to which these records of gage heights can be applied.

Discharge measurements of North Fork of Rogue River at Prospect, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 17	Stevens and McGlashan	20	195	2.43	663
August 26	C. E. Ellsworth	20	194	2.25	476
August 27	do	20	186	2.23	430
September 15	do	20	183	2.13	416
October 31	do	20	182	2.10	485
1908.					
September 19	H. Kimble	24	350	1.90	438

Daily gage height, in feet, of North Fork of Rogue River at Prospect, Oreg., for 1907–8.

[Regular gage.]

Day.	1907. [Samuel Hodges, observer.]				1908. [E. F. Graham, observer.]							
	July.	Aug.	Sept.	Oct.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1		2.31	2.38	2.18				2.4				
2		2.31	2.22	2.17		2.3	2.6					
3		2.30	2.20	2.16					3.2			
4		2.30	2.20	2.15								
5		2.30	2.20	2.14		2.3		2.5				
6		2.30	2.19	2.12			2.2		3.0			
7		2.29	2.19	2.10		2.4				2.7		
8		2.42	2.18	2.09			2.2					
9		2.70	2.18	2.07		2.4						
10		2.40	2.17	2.06					3.0			
11		2.36	2.17				2.2					
12		2.32	2.16			2.3		2.8				
13		2.30	2.15				2.3					
14		2.28	2.15			2.2				2.9		
15		2.28	2.15		2.9		3.4					
16		2.27	2.22			2.2						
17	2.43	2.26	2.25		2.7				2.8			
18	2.42	2.25	2.20				3.0					
19	2.40	2.25	2.18			2.2		3.3				
20	2.40	2.24	2.16									
21	2.40	2.23	2.16			2.2						
22	2.40	2.23	2.15				2.8	3.3				
23	2.40	2.22	2.15									
24	2.38	2.40	2.15			2.2			2.9			
25	2.37	2.30	2.15				2.9					
26	2.36	2.26	2.15		2.5	2.2		3.1				
27	2.35	2.24	2.15						2.8			
28	2.35	2.23	2.20			2.4						
29	2.34	2.22	2.18		2.4		2.6	3.2				
30	2.33	2.21	2.18									
31	2.32	2.21			2.2				2.8			

Daily gage height, in feet, of North Fork of Rogue River at Prospect, Oreg., 1908.

[Gage at house.]

[E. F. Graham, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.8	2.2	2.0	2.7	2.4	2.3	1.5	1.6	.....	1.5	1.7
2	.....	1.9	2.2	2.0	2.7	2.4	2.2	1.5	1.6	.....	1.5	1.6
3	.....	1.8	2.0	2.0	2.8	2.4	2.0	1.5	1.6	.....	1.5	1.6
4	.....	1.8	1.9	2.0	2.7	2.4	2.0	1.5	1.6	1.5	1.4	1.6
5	.....	1.9	1.8	2.1	2.6	2.3	2.0	1.4	1.6	1.5	1.4	1.6
6	2.3	1.9	1.8	2.0	2.6	2.3	2.0	1.4	1.6	1.5	1.4	1.5
7	2.3	2.0	1.8	2.0	2.7	2.3	2.0	1.4	1.7	1.5	1.4	1.5
8	2.3	1.9	1.8	2.0	2.7	2.4	2.2	1.4	1.7	1.4	1.5	1.5
9	2.5	2.0	1.7	2.0	2.6	2.5	2.2	1.5	1.6	1.4	1.5	1.4
10	2.4	2.0	1.8	2.0	2.6	2.8	2.1	1.5	1.6	1.4	1.5	1.4
11	2.3	2.0	1.8	2.1	2.5	2.8	2.0	1.6	1.6	1.4	1.6	1.5
12	2.3	1.9	1.8	2.2	2.4	2.7	2.0	1.6	1.6	1.5	1.6	1.6
13	2.3	1.8	1.9	2.4	2.3	2.6	1.9	1.6	1.6	1.6	1.6	1.6
14	2.3	1.8	1.9	2.6	2.3	2.5	1.8	1.5	1.6	3.0	1.6	1.5
15	2.5	1.8	3.0	2.8	2.4	2.5	1.7	1.5	1.6	2.6	1.6	1.5
16	2.4	1.8	2.9	2.9	2.5	2.5	1.7	1.6	1.6	2.5	1.7	1.5
17	2.3	1.8	3.0	2.8	2.4	2.4	1.6	1.6	1.6	2.4	1.7	1.5
18	2.3	1.8	2.6	2.8	2.5	2.4	1.7	1.6	1.6	2.4	1.7	1.5
19	2.3	1.8	2.5	2.9	2.6	2.4	1.7	1.6	1.6	2.3	1.7	1.5
20	2.5	1.8	2.4	3.0	2.6	2.5	1.7	1.7	1.6	2.1	2.1	1.5
21	2.4	1.8	2.3	2.9	2.5	2.4	1.6	1.6	1.6	2.0	2.2	1.6
22	2.4	1.8	2.4	2.9	2.4	2.4	1.6	1.6	1.6	1.8	2.3	1.6
23	2.3	1.8	2.2	2.8	2.4	2.4	1.6	1.6	1.6	1.7	2.3	1.7
24	2.3	1.8	2.2	3.0	2.5	2.5	1.8	1.5	1.6	1.6	2.2	1.7
25	2.2	1.8	2.5	2.8	2.5	2.4	1.7	1.5	1.6	1.5	2.2	1.8
26	2.1	1.8	2.3	2.7	2.5	2.3	1.6	1.5	1.6	1.5	2.1	1.9
27	2.0	1.9	2.3	2.7	2.4	2.3	1.6	1.6	1.6	1.5	2.0	1.9
28	2.0	2.0	2.0	2.6	2.4	2.3	1.6	1.6	1.6	1.5	1.8	1.9
29	2.0	2.1	2.2	2.8	2.4	2.5	1.5	1.6	1.6	1.5	1.7	2.0
30	2.0	.....	2.1	2.8	2.4	2.3	1.5	1.6	1.6	1.6	1.7	2.0
31	1.8	.....	2.0	.....	2.4	.....	1.5	1.6	.....	1.6	.....	2.0

ROGUE RIVER NEAR TOLO, OREG.

This station was established August 30, 1905. It is located at Gold Ray, the site of the Rogue River Electric Company's power plant, 1½ miles below Tolo and just below the mouth of Bear Creek.

The data obtained at this station have great value in connection with the use of the river for water-power development and its proposed use for extensive irrigation works, a number of large ditches being already under construction.

The station is located below the tail race of the power plant, at which a dam about 20 feet high forms a large forebay. (See Pl. III, *A*.) The flow at the station is, therefore, irregular, depending upon the amount of water used through the turbines. The velocity of the water at the gaging station is quite swift, and the channel is not stable. It has been impossible to develop a permanent rating curve. The records, particularly those taken at low water, are not as accurate as could be desired.

Discharge measurements of Rogue River near Tolo, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 5	I. E. Oakes	194	1,400	3.20	4,200
May 25	J. C. Stevens	193	1,460	2.98	4,150
September 13	C. E. Ellsworth	182	1,070	.82	1,530
November 2	do	185	1,240	.95	1,900
1908.					
February 10	C. E. Ellsworth	195	1,430	3.15	4,410
May 13	do	190	1,270	2.50	3,190
September 11	H. Kimble	184	1,080	1.20	1,340
November 14	H. D. McGlashan	185	1,100	1.00	1,490
December 29	H. Kimble	190	1,360	2.50	3,480

Daily gage height, in feet, of Rogue River near Tolo, Oreg., for 1907.

[B. A. Melvin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.75	6.65	3.65	3.95	3.2	2.7	2.4	1.3	1.3	0.9	0.9	1.05
2	2.6	9.55	3.45	4.05	3.1	2.65	2.3	1.3	1.3	.9	.9	1.1
3	4.8	16.0	3.35	3.9	3.0	2.7	2.3	1.2	1.4	.8	.9	1.1
4	12.25	17.0	3.3	3.65	2.85	2.6	2.3	1.3	1.3	.9	.9	1.1
5	4.75	15.0	3.2	3.8	2.8	2.7	2.2	1.3	1.3	.9	.85	1.1
6	3.7	9.65	3.1	8.25	2.8	2.7	2.2	1.3	1.3	.8	.8	1.05
7	3.45	7.25	3.0	7.5	2.75	2.7	2.2	1.4	1.3	.8	.8	1.0
8	3.1	6.45	3.05	6.25	2.7	2.7	2.3	1.3	1.2	.8	.8	2.55
9	2.6	5.25	3.0	5.8	2.7	2.7	2.3	1.6	1.2	.8	.8	2.1
10	2.55	5.25	3.0	6.0	2.75	2.7	2.2	1.4	1.1	.8	.8	2.1
11	2.4	5.1	3.1	5.8	2.75	2.65	1.85	1.3	1.1	.8	.8	1.6
12	2.35	4.4	3.1	5.45	2.9	2.6	1.8	1.3	.9	.8	.8	3.0
13	2.25	4.4	2.95	5.4	2.8	2.6	1.8	1.5	.9	.8	.7	5.25
14	2.3	4.25	2.85	5.25	2.75	2.6	1.7	1.55	1.1	.8	.7	2.7
15	2.15	4.15	2.8	5.1	2.7	2.65	1.8	1.5	.8	.7	.7	1.95
16	2.1	4.05	2.8	4.7	2.7	2.6	1.7	1.35	.8	.7	.7	1.75
17	2.1	3.7	3.0	4.45	2.6	2.55	1.7	1.3	1.1	.7	.7	2.0
18	2.05	3.4	13.25	4.25	2.6	2.6	1.6	1.3	1.1	.7	.8	1.75
19	2.0	3.5	7.75	4.3	2.75	2.5	1.6	1.3	.8	.7	.8	1.65
20	1.95	3.4	8.75	4.15	2.75	2.5	1.6	1.1	.8	.6	.8	2.0
21	1.95	3.45	7.25	4.1	2.65	2.5	1.7	1.1	.8	.8	1.1	2.05
22	1.9	3.95	6.65	4.1	2.75	2.55	1.7	1.2	.8	.8	1.0	7.0
23	1.95	4.4	6.1	4.05	2.8	2.5	1.55	1.3	.8	.8	1.2	5.65
24	2.05	4.75	5.3	4.0	2.8	2.5	1.45	1.35	.9	.6	1.0	7.25
25	2.2	4.5	4.75	3.85	2.8	2.45	1.4	1.3	.8	.7	1.5	4.1
26	2.6	4.3	4.25	3.75	2.75	2.5	1.4	1.2	.9	.7	1.2	11.6
27	2.9	3.95	4.2	3.55	2.7	2.4	1.3	1.2	.8	.8	1.2	8.0
28	3.8	3.55	4.1	3.4	2.7	2.4	1.3	1.2	.8	.8	1.1	3.45
29	5.2	.....	4.0	3.3	2.75	2.4	1.2	1.2	.8	.8	1.0	4.7
30	4.6	.....	3.9	3.2	2.8	2.4	1.3	1.1	.8	1.1	1.0	4.0
31	4.8	.....	4.0	.....	2.75	.....	1.3	1.2	.....	1.2	.....	4.1

A. DAM AND POWER PLANT ON ROGUE RIVER NEAR TOLO, OREG.

B. CULTIVATED LAND UNDER KENNEWICK CANAL, 2 MILES SOUTH OF KENNEWICK, WASH.

Dailg gaye height, in feet, of Rogue River near Tolo, Oreg., for 1908.

[F. H. Farrar, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.9	2.4	2.5	2.4	3.5	2.55	2.3	1.3	1.0	1.05	1.2	1.55
2	3.5	2.4	2.5	2.4	3.5	2.5	2.3	1.25	1.0	1.05	1.2	1.5
3	3.45	2.35	2.5	2.45	3.5	2.45	2.3	1.2	.95	1.1	1.2	1.5
4	3.45	2.3	2.5	2.5	3.4	2.4	2.3	1.2	.9	1.1	1.2	1.5
5	3.15	2.35	2.4	2.4	3.3	2.4	2.25	1.2	.9	1.05	1.2	1.5
6	3.0	3.8	2.4	2.4	3.05	2.4	2.15	1.15	.9	1.05	1.2	1.5
7	3.0	3.85	2.3	2.4	3.0	2.4	2.0	1.1	.9	1.05	1.1	1.45
8	3.1	3.6	2.25	2.3	2.95	2.5	1.9	1.0	.9	1.0	1.1	1.3
9	5.65	3.5	2.3	2.4	2.85	2.5	1.8	1.0	.9	1.0	1.1	1.3
10	4.75	3.3	2.2	2.4	2.9	2.85	1.8	1.0	.9	1.0	1.1	1.2
11	3.65	3.35	2.2	2.5	2.8	2.95	1.8	1.0	.9	1.0	1.1	1.2
12	3.5	3.25	2.3	2.5	2.8	2.95	1.8	1.0	.9	1.1	1.1	1.2
13	3.3	2.6	2.3	2.95	2.5	2.85	1.8	1.0	1.0	1.1	1.1	1.2
14	6.55	2.5	2.35	3.2	2.95	2.75	1.9	.05	1.0	1.85	1.1	1.2
15	4.3	2.4	2.4	3.8	3.1	2.65	1.85	1.0	1.0	2.8	1.1	1.2
16	3.8	2.5	3.0	3.8	3.1	2.6	1.8	1.0	1.0	2.7	1.1	1.2
17	3.45	2.4	4.15	4.3	3.0	2.55	1.8	1.0	1.0	1.85	1.1	1.2
18	3.3	2.4	3.9	3.95	3.5	2.5	1.8	1.0	1.0	1.75	1.1	1.2
19	3.2	2.4	3.4	3.9	3.55	2.5	1.7	1.0	1.0	1.5	2.4	1.2
20	5.55	2.3	3.2	4.05	3.45	2.4	1.7	1.0	1.0	1.5	3.35	1.2
21	4.25	2.3	3.1	3.95	3.25	2.95	1.7	1.0	1.0	1.5	3.15	1.2
22	3.6	2.3	3.0	3.9	3.2	2.75	1.65	.9	1.0	1.5	4.2	1.2
23	3.2	2.1	2.25	3.8	3.05	2.6	1.6	.9	1.0	1.5	3.4	1.2
24	3.7	2.2	2.2	4.05	3.0	2.5	1.5	.9	1.0	1.35	2.75	1.65
25	3.2	2.2	2.35	3.85	3.0	2.5	1.5	.9	1.0	1.35	3.1	1.9
26	3.1	2.1	2.6	3.75	2.95	2.5	1.5	1.0	1.0	1.3	2.7	1.65
27	3.0	2.25	2.6	3.6	2.9	2.4	1.45	1.0	1.0	1.25	2.6	1.7
28	2.6	2.3	2.5	3.5	2.85	2.4	1.4	1.0	1.0	1.2	2.0	2.15
29	2.5	2.4	2.45	3.5	2.8	2.3	1.3	1.0	1.0	1.2	1.75	2.7
30	2.5	.....	2.4	3.5	2.8	2.3	1.3	1.1	1.0	1.2	1.65	2.5
31	2.4	.....	2.5	.....	2.7	.....	1.3	1.0	.....	1.2	.....	2.05

Rating tables for Rogue River near Tolo, Oreg.

SEPTEMBER 1, 1905, TO FEBRUARY 3, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	2,030	3.20	4,230	4.50	7,230	6.60	13,060
2.00	2,160	3.30	4,440	4.60	7,490	6.80	13,660
2.10	2,300	3.40	4,650	4.70	7,750	7.00	14,260
2.20	2,450	3.50	4,870	4.80	8,010	8.00	17,280
2.30	2,600	3.60	5,090	4.90	8,270	9.00	20,500
2.40	2,760	3.70	5,310	5.00	8,540	10.00	23,850
2.50	2,930	3.80	5,540	5.20	9,080	11.00	27,300
2.60	3,100	3.90	5,770	5.40	9,620	12.00	30,800
2.70	3,280	4.00	6,000	5.60	10,180	13.00	34,300
2.80	3,460	4.10	6,240	5.80	10,740	14.00	37,800
2.90	3,640	4.20	6,480	6.00	11,320	15.00	41,300
3.00	3,830	4.30	6,730	6.20	11,900	16.00	44,800
3.10	4.030	4.40	6,980	6.40	12,480	17.00	48,300

FEBRUARY 4, 1907, TO DECEMBER 31, 1908.[b]

0.60	1,190	1.60	2,030	2.60	3,350	3.60	5,160
.70	1,250	1.70	2,140	2.70	3,510	3.70	5,380
.80	1,320	1.80	2,260	2.80	3,670	3.80	5,600
.90	1,400	1.90	2,380	2.90	3,830	3.90	5,820
1.00	1,480	2.00	2,500	3.00	4,000	4.00	6,050
1.10	1,560	2.10	2,630	3.10	4,180	4.20	6,510
1.20	1,650	2.20	2,760	3.20	4,370	4.40	6,990
1.30	1,740	2.30	2,900	3.30	4,560	4.60	7,490
1.40	1,830	2.40	3,040	3.40	4,750		
1.50	1,920	2.50	3,190	3.50	4,950		

[a] The above table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during 1905-6 and is fairly well defined between gage heights 1.0 feet and 4.0 feet.

[b] The above table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1906-1908, and is not well defined. Above gage height 4.6 feet the table is the same as the 1905-6 table.

Monthly discharge of Rogue River near Tolo, Oreg., for 1907 and 1908.

[Drainage area, 2,020 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	31,700	2,030	4,710	2.33	2.69	290,000	C.
February	48,300	4,750	12,500	6.19	6.45	694,000	C.
March	35,200	3,670	7,650	3.79	4.37	470,000	C.
April	18,100	4,370	7,800	3.86	4.31	464,000	C.
May	4,370	3,350	3,640	1.80	2.08	224,000	C.
June	3,510	3,040	3,310	1.64	1.83	197,000	C.
July	3,040	1,650	2,290	1.13	1.30	141,000	C.
August	2,030	1,560	1,740	.861	.99	107,000	C.
September	1,830	1,320	1,490	.738	.82	88,700	C.
October	1,650	1,190	1,320	.653	.75	81,200	D.
November	1,920	1,250	1,410	.698	.78	83,900	D.
December	29,400	1,480	5,550	2.75	3.17	341,000	D.
The year	48,300	1,190	4,450	2.20	29.54	3,180,000	
1908.							
January	12,900	3,040	5,350	2.65	3.06	329,000	D.
February	5,710	2,630	3,450	1.71	1.84	198,000	D.
March	6,400	2,760	3,420	1.69	1.95	210,000	D.
April	6,750	2,900	4,530	2.24	2.50	270,000	C.
May	5,060	3,190	4,150	2.05	2.36	255,000	C.
June	3,920	2,900	3,290	1.63	1.82	196,000	C.
July	2,900	1,740	2,260	1.12	1.29	139,000	C.
August	1,740	1,400	1,510	.748	.86	92,800	D.
September	1,480	1,400	1,460	.723	.81	86,900	D.
October	3,670	1,480	1,840	.911	1.05	113,000	C.
November	6,510	1,560	2,440	1.21	1.35	145,000	C.
December	3,510	1,650	1,960	.970	1.12	121,000	C.
The year	12,900	1,400	2,970	1.47	20.01	2,160,000	

LITTLE BUTTE CREEK NEAR EAGLE POINT, OREG.

Little Butte Creek is formed near Lake Creek in Jackson County, by the union of its North and South forks, the united waters flowing westward and joining Rogue River about 3 miles east of Table Rock.

The gaging station was established July 13, 1907. It is located at Tronson & Guthrie's fruit ranch, 1 mile above Eagle Point, about 2 miles above the mouth of Antelope Creek, and above the head of a ditch which diverts water for milling at Eagle Point.

A number of small ditches divert water from the stream above the station, so that the flow here obtained does not represent the natural run-off from the drainage area. The data are insufficient for an estimate of extreme values.

This stream is already used to a large extent for irrigation and additional developments are under way. It also furnishes municipal water supply for the city of Medford.

Discharge measurements of Little Butte Creek near Eagle Point, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 13	J. C. Stevens	65	149	1.10	81
August 28	C. E. Ellsworth	64	149	1.10	86
September 13	do	64	143	1.08	68
October 30	do	64	159	1.30	117
1908.					
February 9	C. E. Ellsworth	65	266	2.22	414
May 13	do	64	227	1.92	271
September 12	H. Kimble	64	145	.90	42
November 16	H. D. McGlashan	64	186	1.19	81
December 28	H. Kimble	64	229	1.66	217

Daily gage height, in feet, of Little Butte Creek near Eagle Point, Oreg., for 1907 and 1908.

[Trouson and Guthrie, observers.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.							1907.						
1	.....	0.90	1.30	1.32	1.25	1.40	16	1.09	1.15	1.10	1.25	1.20	1.58
2	.....	.90	1.25	1.35	1.32	1.35	17	1.09	1.10	1.10	1.20	1.20	1.50
3	.....	.90	1.15	1.30	1.35	1.35	18	1.09	1.10	1.10	1.20	1.20	1.50
4	.....	.90	1.15	1.30	1.35	1.35	19	1.09	1.10	1.10	1.20	1.20	1.75
5	.....	.90	1.15	1.30	1.30	1.35	20	1.05	1.05	1.10	1.20	1.35	1.73
6	.....	.90	1.10	1.30	1.30	1.35	21	1.05	1.05	1.10	1.20	1.50	1.70
7	.....	.90	1.10	1.30	1.30	1.35	22	1.05	1.05	1.10	1.20	1.42	4.55
8	.....	1.17	1.10	1.30	1.28	1.35	23	1.05	1.05	1.10	1.20	1.40	6.15
9	.....	1.32	1.10	1.30	1.28	1.30	24	1.05	1.37	1.10	1.20	1.40	3.60
10	.....	1.24	1.10	1.30	1.28	1.30	25	1.00	1.28	1.10	1.20	1.40	3.68
11	.....	1.20	1.10	1.30	1.28	1.35	26	1.00	1.15	1.10	1.20	1.35	7.65
12	.....	1.20	1.10	1.30	1.28	2.27	27	1.00	1.15	1.25	1.25	1.35	4.50
13	1.10	1.15	1.10	1.30	1.28	3.45	28	1.00	1.10	1.25	1.25	1.35	3.10
14	1.09	1.15	1.10	1.25	1.28	2.35	29	.95	1.10	1.20	1.25	1.40	2.75
15	1.09	1.15	1.10	1.25	1.20	1.90	30	.95	1.10	1.15	1.25	1.40	2.65
							31	.95	1.10	.....	1.25	.....	2.40

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.30	1.50	1.90	1.85	1.72	1.85	1.02	0.80	0.80	1.10	1.30	2.40
2	2.15	1.40	1.60	1.95	1.62	1.85	1.00	.80	.80	1.10	1.30	2.35
3	2.00	1.40	1.48	2.00	1.60	1.80	1.00	.80	.80	1.10	1.28	2.32
4	2.10	1.30	1.45	2.00	1.60	1.80	1.00	.80	.80	1.10	1.25	2.20
5	2.02	2.67	1.38	2.10	1.72	1.80	1.00	.80	.80	1.10	1.25	2.20
6	1.90	2.25	1.30	2.10	1.80	1.80	1.00	.80	.80	1.10	1.25	2.15
7	1.78	1.70	1.30	2.10	2.00	1.72	1.00	.80	.80	1.10	1.20	2.12
8	1.80	1.50	1.30	2.15	2.00	1.65	1.00	.80	.80	1.10	1.20	2.08
9	3.00	2.15	1.30	2.15	1.95	1.58	1.00	.80	.80	1.10	1.20	2.05
10	2.40	2.10	1.30	2.12	1.95	1.55	1.00	.80	.80	1.10	1.20	2.00
11	2.15	1.90	1.30	2.10	1.90	1.48	1.00	.80	.80	1.10	1.20	2.00
12	2.05	1.90	1.60	1.70	1.98	1.45	1.00	.80	.80	1.10	1.20	2.40
13	2.10	1.70	1.75	1.70	2.00	1.40	1.00	.80	.80	1.10	1.20	2.28
14	4.70	1.70	1.85	1.90	2.00	1.30	1.00	.80	.80	1.10	1.20	2.20
15	3.00	1.60	1.95	2.20	2.65	1.30	.95	.80	.80	2.72	1.20	2.10
16	2.25	1.60	2.10	3.05	2.70	1.30	.92	.80	1.00	2.62	1.35	2.00
17	2.20	1.50	2.40	2.95	2.55	1.30	.90	.80	.95	2.50	1.30	1.85
18	2.20	1.40	2.25	2.95	3.30	1.30	.90	.80	.95	2.38	1.30	1.55
19	2.25	1.40	1.95	2.90	3.20	1.30	.90	.80	1.10	2.15	1.30	1.25
20	3.00	1.40	2.05	2.78	3.00	1.30	.90	.80	1.10	1.98	2.15	1.35
21	2.70	1.30	2.10	2.68	2.90	1.25	.90	.80	1.10	1.82	2.00	1.25
22	2.60	1.30	2.10	2.60	2.80	1.25	.90	.80	1.10	1.72	3.25	1.25
23	2.20	1.30	2.10	2.50	2.90	1.20	.90	.80	1.10	1.65	2.80	2.32
24	1.90	1.40	2.20	2.40	2.65	1.20	.90	.80	1.10	1.65	3.00	1.70
25	1.70	1.40	2.15	2.30	2.50	1.20	.90	.80	1.10	1.60	2.70	1.48
26	1.50	1.30	2.05	2.10	2.40	1.20	.90	.80	1.10	1.55	2.60	2.38
27	1.50	1.30	2.00	2.05	2.05	1.20	.90	.80	1.10	1.52	2.60	1.82
28	1.50	1.30	1.90	2.00	2.00	1.15	.90	.80	1.10	1.50	2.58	2.25
29	1.50	1.85	1.90	1.92	1.95	1.12	.85	.80	1.10	1.45	2.52	1.78
30	1.50	.....	1.80	1.85	1.95	1.10	.85	.80	1.10	1.45	2.50	1.60
31	1.50	.....	1.80	.....	1.90	.....	.85	.80	.....	1.40	.....	1.50

Rating table for Little Butte Creek, near Eagle Point, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	33	2.10	351	3.40	950	5.40	2,200
.90	44	2.20	388	3.50	1,000	5.60	2,340
1.00	58	2.30	428	3.60	1,060	5.80	2,480
1.10	74	2.40	473	3.70	1,120	6.00	2,620
1.20	92	2.50	518	3.80	1,180	6.20	2,770
1.30	113	2.60	564	3.90	1,240	6.40	2,920
1.40	136	2.70	610	4.00	1,300	6.60	3,070
1.50	162	2.80	656	4.20	1,420	6.80	3,220
1.60	190	2.90	703	4.40	1,540	7.00	3,370
1.70	220	3.00	750	4.60	1,665	8.00	4,170
1.80	251	3.10	800	4.80	1,795		
1.90	283	3.20	850	5.00	1,925		
2.00	316	3.30	900	5.20	2,060		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1907–8, and is well defined between gage heights 0.9 foot and 2.2 feet.

Monthly discharge of Little Butte Creek near Eagle Point, Oreg., for 1907 and 1908.

[Drainage area, 309 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
July 13–31	74	51	64.3	0.208	0.15	2,420	B.
August	129	44	74.4	.241	.28	4,570	B.
September	113	74	79.9	.259	.29	4,750	B.
October	124	92	104	.337	.39	6,400	B.
November	162	92	117	.379	.42	6,960	B.
December	3,890	113	619	2.00	2.31	38,100	C.
The period						63,200	
1908.							
January	1,730	162	410	1.33	1.53	25,200	B.
February	596	113	201	.650	.70	11,600	B.
March	473	113	257	.832	.96	15,800	B.
April	775	220	418	1.35	1.51	24,900	B.
May	900	190	424	1.37	1.58	26,100	B.
June	267	74	149	.482	.54	8,870	B.
July	61	38	50.2	.162	.19	3,090	B.
August	33	33	33.0	.107	.12	2,030	C.
September	74	33	51.4	.166	.19	3,060	B.
October	619	74	191	.618	.71	11,700	B.
November	875	92	275	.890	.99	16,400	B.
December	473	102	308	.997	1.15	18,900	B.
The year	1,730	33	231	.746	10.17	168,000	

BEAR CREEK AT TALENT, OREG.

Bear Creek, formerly known as Stewart Creek, rises in the southeastern part of Jackson County, and flows northwestward to its junction with Rogue River near Tolo. Its entire drainage area comprises 380 square miles.

The gaging station was established July 11, 1907, at a highway bridge at Talent, 500 feet above the head of a power and irrigation

canal which diverts water from the left bank, about one-half mile below the mouth of Wagner Creek and 1½ miles above the mouth of Anderson Creek.

The stream is used largely for irrigation and the data obtained at this station are useful in that connection. Any increase of irrigation development from this stream will require the construction of storage reservoirs.

The conditions are not exceptionally favorable for good results. The bed of the stream is somewhat changeable and a new rating curve will have to be developed after each flood.

Discharge measurements of Bear Creek at Talent, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 11 [a]	J. C. Stevens	39	29	2.27	18
August 30 [b]	C. E. Ellsworth	24	12	2.26	9
September 10 [b]	do	30	16	2.48	11
November 2 [b]	do	32	17	2.90	24
1908.					
February 11	C. E. Ellsworth	60	77	3.78	137
May 12	do	55	74	3.55	115
September 10 [a]	H. Kimble	14	5.1	2.85	2.3
November 15	H. D. McGlashan	48	51	3.10	19
December 29	H. Kimble	47	56	3.20	43

[a] Measured by wading.
[b] Measurements made by wading below headgate of canal. The estimated flow in the canal of 10 second-feet has been added in constructing the curve.

Daily gage height, in feet, of Bear Creek at Talent, Oreg., for 1907 and 1908.

[George Jeffery, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.							1907.						
1	.....	2.34	3.00	2.60	2.70	2.90	16	2.60	2.50	.....	2.50	2.80	2.80
2	.....	2.20	2.90	2.70	2.95	2.90	17	2.60	2.50	.....	2.50	2.90	2.80
3	.....	2.10	2.85	2.60	2.85	2.90	18	2.55	2.50	.....	2.45	2.90	2.80
4	.....	2.20	2.70	2.50	2.80	2.90	19	2.55	2.50	.....	2.45	2.90	2.90
5	.....	2.20	2.70	2.50	2.80	2.95	20	2.50	2.30	.....	2.40	3.00	2.90
6	.....	2.20	2.70	2.45	2.80	2.90	21	2.50	2.40	.....	2.45	3.10	2.90
7	.....	2.20	2.70	2.45	3.00	2.95	22	2.40	2.30	.....	2.45	3.00	3.80
8	.....	2.60	2.70	2.40	2.80	2.90	23	2.30	2.30	.....	2.45	3.00	4.00
9	.....	2.70	.....	2.40	2.90	2.90	24	2.30	2.90	.....	2.60	3.00	3.60
10	.....	2.70	2.48	2.40	2.80	2.95	25	2.30	2.80	.....	2.60	3.00	3.50
11	2.27	2.60	.....	2.40	2.70	3.05	26	2.30	2.70	.....	2.60	3.00	5.80
12	2.27	2.55	.....	2.55	2.70	3.10	27	2.30	2.60	.....	2.60	3.00	4.40
13	2.40	2.55	.....	2.45	2.70	3.55	28	2.40	2.50	.....	2.85	3.00	3.90
14	2.40	2.50	.....	2.60	2.80	3.10	29	2.50	2.35	.....	2.80	3.00	3.70
15	2.45	2.50	.....	2.60	2.90	2.95	30	2.50	2.26	.....	2.80	3.00	3.60
							31	2.40	2.25	.....	2.80	.....	3.80

Daily gage height, in feet, of Bear Creek at Talent, Oreg., for 1907 and 1908—Continued.

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	3.8	3.6	3.7	3.6	3.45	3.4	3.1	2.9	2.9	2.95	3.2	3.2
2	3.65	3.6	3.6	3.6	3.5	3.45	3.2	2.9	2.9	3.0	3.2	3.15
3	3.6	3.6	3.6	3.6	3.5	3.45	3.2	2.9	2.9	3.0	3.2	3.15
4	3.6	3.6	3.6	3.6	3.5	3.4	3.2	2.9	2.85	3.0	3.2	3.15
5	3.5	3.6	3.6	3.6	3.5	3.4	3.2	2.85	2.85	3.0	3.2	3.15
6	3.5	3.7	3.6	3.6	3.5	3.4	3.2	2.85	2.85	3.0	3.2	3.15
7	3.5	3.8	3.6	3.55	3.5	3.4	3.15	2.85	2.85	3.0	3.2	3.15
8	3.5	3.8	3.6	3.55	3.45	3.4	3.15	2.85	2.85	3.0	3.2	3.15
9	4.1	3.6	3.6	3.55	3.45	3.4	3.15	2.9	2.8	3.0	3.2	3.15
10	3.7	3.6	3.6	3.55	3.45	3.4	3.15	2.9	2.8	3.0	3.2	3.15
11	3.65	3.6	3.6	3.6	3.5	3.5	3.15	2.9	2.8	3.0	3.2	3.15
12	3.65	3.6	3.6	3.6	3.5	3.4	3.15	2.9	2.8	3.0	3.2	3.15
13	3.7	3.6	3.6	3.7	3.5	3.4	3.2	2.9	2.8	3.0	3.15	3.15
14	5.0	3.6	3.6	3.7	3.5	3.35	3.2	2.9	2.8	3.7	3.1	3.15
15	4.3	3.7	3.6	4.05	3.65	3.35	3.2	2.9	2.9	3.45	3.1	3.15
16	4.1	3.7	4.2	4.0	3.75	3.35	3.1	2.9	2.9	3.25	3.08	3.15
17	4.0	3.7	3.9	3.8	3.85	3.4	3.1	2.9	2.9	3.25	3.1	3.1
18	4.0	3.65	3.85	3.75	4.05	3.4	3.1	2.85	2.9	3.2	3.1	3.1
19	4.0	3.65	3.8	3.7	3.85	3.4	3.05	2.85	2.9	3.2	3.1	3.1
20	4.6	3.6	3.8	3.7	3.8	3.4	3.0	2.85	2.9	3.2	3.5	3.1
21	4.3	3.6	3.8	3.75	3.8	3.4	3.0	2.8	2.9	3.15	3.35	3.1
22	4.1	3.6	3.7	3.75	3.8	3.35	3.0	2.8	2.9	3.15	3.35	3.15
23	4.0	3.6	3.7	3.7	3.65	3.3	3.0	2.8	2.9	3.1	3.3	3.15
24	4.05	3.6	3.7	3.75	3.6	3.3	3.0	2.8	2.95	3.1	3.3	3.2
25	3.9	3.6	3.7	3.7	3.55	3.3	3.0	2.85	2.95	3.1	3.3	3.2
26	3.85	3.6	3.7	3.6	3.5	3.25	2.95	2.9	2.95	3.1	3.25	3.2
27	3.8	3.65	3.7	3.6	3.5	3.2	2.95	2.9	2.95	3.1	3.2	3.2
28	3.7	3.65	3.65	3.55	3.45	3.2	2.95	2.9	2.95	3.1	3.2	3.2
29	3.7	3.65	3.65	3.55	3.45	3.2	2.95	2.9	2.95	3.1	3.2	3.2
30	3.7	.....	3.6	3.5	3.45	3.2	2.9	2.9	2.95	3.1	3.2	3.2
31	3.6	.....	3.6	.....	3.45	.....	2.9	2.9	.....	3.1	.....	3.2

Rating tables for Bear Creek at Talent, Oreg.

FOR 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	14	3.10	54	4.10	183	5.10	440
2.20	16	3.20	62	4.20	203	5.20	470
2.30	18	3.30	70	4.30	225	5.30	500
2.40	20	3.40	80	4.40	250	5.40	530
2.50	23	3.50	91	4.50	275	5.50	560
2.60	26	3.60	103	4.60	300	5.60	590
2.70	30	3.70	117	4.70	325	5.70	620
2.80	35	3.80	131	4.80	350	5.80	650
2.90	41	3.90	147	4.90	380		
3.00	47	4.00	165	5.00	410		

FOR 1908.[b]

2.80	2	3.40	72	4.00	205	4.60	372
2.90	6	3.50	90	4.10	231	4.70	402
3.00	14	3.60	112	4.20	258	4.80	434
3.10	24	3.70	134	4.30	285	4.90	467
3.20	38	3.80	157	4.40	313	5.00	500
3.30	54	3.90	180	4.50	342		

[a] The above table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1907–8 and is not well defined. Three 1907 measurements, used in constructing the table, were made below the headgate of a canal, and an estimated flow of 10 second-feet for the canal has been added.

[b] The above table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1908 and is fairly well defined below gage height 3.8 feet.

Monthly discharge of Bear Creek at Talent, Oreg., for 1907 and 1908.

[Drainage area, 226 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
July 11–31	26	17	20.9	.092	.07	871	C.
August	41	14	22.4	.099	.11	1,380	C.
September 1–10	47	22	32.4	.143	.05	643	C.
October	38	20	24.9	.110	.13	1,530	C.
November	54	30	40.8	.181	.20	2,430	C.
December	650	35	91.4	.404	.47	5,620	C.
1908.							
January	500	90	180	.796	.92	11,100	C.
February	157	112	120	.531	.57	6,900	C.
March	258	112	131	.580	.67	8,060	C.
April	218	90	126	.558	.62	7,500	C.
May	218	81	108	.478	.55	6,640	C.
June	90	38	64.8	.287	.32	3,860	C.
July	38	6	23.9	.106	.12	1,470	C.
August	6	2	4.97	.022	.03	306	D.
September	10	2	5.80	.026	.03	345	D.
October	134	10	28.3	.125	.14	1,740	C.
November	90	22	40.2	.178	.20	2,390	C.
December	38	24	31.9	.141	.16	1,960	C.
The year	500	2	72.1	.319	4.33	52,300	

APPLEGATE CREEK AT MURPHY, OREG.

Applegate Creek rises in the Siskiyou Mountains in the northwestern part of Siskiyou County, Cal., flows northeastward into Jackson County, Oreg., for about 20 miles, then turns to the northwest and unites with Rogue River about 8 miles west of Grants Pass in Josephine County. Its drainage area measures 606 square miles.

This station was established July 22, 1907. It is located at Murphy, 8 miles above the mouth of the creek and 7 miles from Grants Pass.

The data obtained at this station are needed in connection with the use of the stream for irrigation, mining, and the development of water power. Small ditches are numerous in the vicinity of the station, but most of them serve only a single farm. It has been observed that since early irrigation has been practiced the summer flow of the stream at this point is more uniformly maintained than before.

The conditions at the station are not favorable for very good results. The height of the water is affected in an irregular manner by a dam a short distance below, and as this dam is a temporary affair, made of brush, it is washed away, either wholly or in part, with every rise in the creek, even during irrigating seasons. For this reason it was necessary during 1907 and 1908 to develop four rating curves, and to interpolate a part of the records.

Discharge measurements of Applegate Creek at Murphy, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 22	H. D. McGlashan	155	307	4.17	163
August 29 [a]	C. E. Ellsworth	78	68	4.23	75
September 11 [a]	do	78	69	4.28	78
October 29 [a]	do	80	75	4.25	114
1908.					
February 8	C. E. Ellsworth	157	560	5.45	1,320
March 11	do	157	562	5.10	910
May 1	do	156	480	4.94	680
September 13 [a]	H. Kimble	22	20	4.50	46
November 11	H. D. McGlashan	155	384	4.41	148
December 30	H. Kimble	156	494	4.90	497

[a] Measured by wading.

Daily gage height, in feet, of Applegate Creek at Murphy, Oreg., for 1907 and 1908.

[J. W. Gilmore, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.							1907.						
1	.....	4.40	4.35	4.35	4.35	4.35	16	.....	4.40	4.29	4.10	4.22	4.80
2	.....	4.45	4.40	4.35	4.40	4.35	17	.....	4.35	4.30	4.10	4.22	4.80
3	.....	4.40	4.40	4.35	4.38	4.32	18	.....	4.30	4.31	4.10	4.25	4.80
4	.....	4.40	4.40	4.35	4.35	4.40	19	.....	4.30	4.33	4.10	4.28	4.82
5	.....	4.40	4.40	4.35	4.35	4.58	20	.....	4.25	4.33	4.10	4.32	4.82
6	.....	4.40	4.40	4.32	4.30	4.50	21	.....	4.25	4.35	4.10	4.40	4.78
7	.....	4.50	4.40	4.32	4.30	4.50	22	4.17	4.20	4.34	4.10	4.40	5.88
8	.....	4.60	4.35	4.30	4.28	4.60	23	4.10	4.20	4.33	4.12	4.40	6.00
9	.....	4.95	4.35	4.27	4.28	4.62	24	4.14	4.20	4.32	4.15	4.40	5.95
10	.....	4.90	4.25	4.25	4.25	4.65	25	4.10	4.20	4.31	4.15	4.40	5.90
11	.....	4.70	4.28	4.20	4.22	5.00	26	4.20	4.20	4.30	4.15	4.40	9.52
12	.....	4.55	4.28	4.10	4.20	5.50	27	4.16	4.30	4.27	4.17	4.45	6.60
13	.....	4.50	4.28	4.10	4.20	5.72	28	4.40	4.30	4.25	4.20	4.42	6.00
14	.....	4.45	4.27	4.10	4.20	5.12	29	4.45	4.30	4.27	4.25	4.40	5.80
15	.....	4.40	4.27	4.10	4.20	5.00	30	4.50	4.30	4.30	4.25	4.38	5.85
							31	4.40	4.30	.....	4.30	.....	5.85

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5.65	4.95	5.10	4.95	5.20	4.90	4.65	4.58	4.47	4.15	4.75	4.75
2	5.50	4.90	5.09	4.92	5.22	4.88	4.60	4.60	4.45	4.14	4.50	4.70
3	5.35	4.88	5.10	4.90	5.12	4.86	4.57	4.59	4.48	4.13	4.50	4.70
4	5.28	4.85	5.05	4.90	5.00	4.82	4.57	4.57	4.50	4.14	4.50	4.68
5	5.18	4.88	5.00	4.90	5.02	4.85	4.60	4.56	4.50	4.16	4.50	4.65
6	5.12	6.00	4.98	4.90	5.05	4.90	4.57	4.55	4.50	4.17	4.50	4.63
7	5.08	5.60	4.95	4.87	5.10	4.95	4.56	4.52	4.50	4.19	4.50	4.62
8	5.12	5.48	4.95	4.87	5.05	5.12	4.50	4.50	4.50	4.20	4.47	4.60
9	6.05	5.58	4.98	4.90	5.00	5.20	4.47	4.50	4.50	4.23	4.44	4.60
10	5.75	5.42	5.10	4.94	4.95	5.20	4.46	4.50	4.50	4.25	4.43	4.58
11	5.48	5.40	5.10	4.95	5.00	5.20	4.45	4.50	4.50	4.27	4.42	4.57
12	5.40	5.35	5.15	5.30	4.95	5.20	4.43	4.50	4.50	4.30	4.41	4.57
13	5.40	5.25	5.22	5.33	4.92	5.20	4.40	4.50	4.50	4.30	4.40	4.60
14	5.50	5.20	5.30	5.30	4.91	5.20	4.40	4.50	4.50	5.75	4.40	4.51
15	5.60	5.18	5.45	5.42	4.90	5.17	4.40	4.50	4.50	5.40	4.40	4.54
16	5.50	5.18	5.65	5.47	4.87	5.05	4.37	4.50	4.50	4.93	4.40	4.52
17	5.42	5.12	5.80	5.30	4.90	5.02	4.35	4.50	4.50	4.75	4.40	4.50
18	5.35	5.10	5.58	5.50	5.20	4.98	4.32	4.50	4.50	4.60	4.40	4.50
19	5.35	5.09	5.42	5.60	5.05	4.93	4.30	4.50	4.50	4.60	4.55	4.50
20	6.20	5.05	5.30	5.50	5.00	4.90	4.75	4.50	4.55	4.56	5.60	4.50
21	5.80	5.00	5.18	5.40	4.95	4.97	4.75	4.47	4.60	4.50	5.52	4.55
22	5.60	4.98	5.20	5.35	5.00	4.90	4.73	4.45	4.60	4.50	6.00	4.60
23	5.50	4.95	5.20	5.32	5.00	4.85	4.71	4.43	4.60	4.50	5.50	4.75
24	5.40	4.92	5.20	5.30	5.00	4.80	4.70	4.42	4.62	4.50	5.50	4.90
25	5.30	4.90	5.20	5.27	5.00	4.80	4.69	4.43	4.64	4.50	5.40	4.78
26	5.20	4.90	5.19	5.20	4.97	4.78	4.68	4.45	4.65	4.50	5.30	4.75
27	5.15	4.92	5.18	5.20	4.95	4.76	4.67	4.47	4.65	4.50	5.20	4.70
28	5.10	4.98	5.18	5.13	4.92	4.74	4.66	4.48	4.65	4.50	4.90	4.70
29	5.05	4.98	5.00	5.13	5.00	4.71	4.64	4.50	4.20	4.50	4.95	4.95
30	5.02	.....	4.95	5.12	4.95	4.68	4.62	4.50	4.15	4.60	4.80	4.88
31	4.98	.....	4.92	.....	4.90	.....	4.60	4.48	.....	4.90	.....	4.80

Daily discharge, in second-feet, of Applegate Creek at Murphy, Oreg., for 1907 and 1908.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.							1907.						
1	.....	142	118	118	158	255	16	.....	142	91	70	185	585
2	.....	170	142	118	186	255	17	.....	118	95	70	185	585
3	.....	142	142	118	175	237	18	.....	95	100	70	200	585
4	.....	142	142	118	158	285	19	.....	95	109	70	215	604
5	.....	142	142	118	160	406	20	.....	77	109	70	237	604
6	.....	142	142	104	162	350	21	.....	77	118	70	285	568
7	.....	197	142	104	164	350	22	163	59	114	70	285	2,070
8	.....	260	118	95	167	420	23	135	59	109	76	285	2,300
9	.....	544	118	84	169	436	24	151	59	104	85	285	2,200
10	.....	497	77	77	171	460	25	135	59	100	85	285	2,110
11	.....	332	88	59	173	780	26	175	59	95	85	285	11,600
12	.....	228	88	70	175	1,400	27	159	95	84	91	318	3,550
13	.....	197	88	70	175	1,780	28	142	95	77	100	298	2,300
14	.....	170	84	70	175	902	29	170	95	84	115	285	1,920
15	.....	142	84	70	175	780	30	197	95	95	115	273	2,020
							31	142	95	.....	130	.....	2,020

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	1,660	730	880	730	990	680	460	80	38	46	372	372
2	1,400	680	870	700	1,010	661	420	88	33	44	197	332
3	1,180	661	880	680	902	642	399	84	41	42	197	332
4	1,090	632	830	680	780	604	399	75	46	44	197	318
5	968	661	780	680	800	632	420	71	46	49	197	296
6	902	2,300	760	680	830	680	399	67	46	52	197	282
7	860	1,570	730	652	880	730	392	54	46	56	197	274
8	902	1,370	730	652	830	902	350	46	46	59	180	260
9	2,400	1,540	760	680	780	990	330	46	46	70	164	260
10	1,830	1,280	880	720	730	990	324	46	46	77	158	247
11	1,370	1,250	880	730	780	990	318	46	46	84	153	241
12	1,250	1,180	935	1,110	730	990	305	46	46	95	148	241
13	1,250	1,050	1,010	1,150	700	990	285	46	46	95	142	260
14	1,400	990	1,110	1,110	690	990	285	46	46	1,540	142	203
15	1,570	968	1,320	1,280	680	957	285	46	46	1,030	142	222
16	1,400	968	1,660	1,360	652	830	267	46	46	525	142	210
17	1,280	902	1,920	1,110	680	800	255	46	46	372	142	197
18	1,180	880	1,540	1,400	990	760	237	46	46	260	142	197
19	1,180	870	1,280	1,570	830	710	225	46	46	260	228	197
20	2,690	830	1,110	1,400	780	680	190	46	67	235	1,300	197
21	1,920	780	968	1,250	730	750	190	38	88	197	1,190	228
22	1,570	760	990	1,180	780	680	174	33	88	197	2,000	260
23	1,400	730	990	1,140	780	632	158	28	88	197	1,160	372
24	1,250	700	990	1,110	780	585	150	25	100	197	1,160	497
25	1,110	680	990	1,070	780	585	144	28	113	197	1,030	396
26	990	680	979	990	750	568	138	33	119	197	910	372
27	935	700	968	990	730	551	131	38	119	197	800	332
28	880	760	968	913	700	534	125	41	119	197	497	332
29	830	760	780	913	780	508	113	46	59	197	544	544
30	800	.....	730	902	730	484	100	46	46	260	412	480
31	760	.....	700	.....	680	.....	88	41	.....	497	.....	412

NOTE.—These discharges were obtained from tables covering the periods of time between the putting in and going out of the temporary dams.

Monthly discharge of Applegate Creek at Murphy, Oreg., for 1907 and 1908.

[Drainage area, 620 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
July 22–31	197	135	157	0.253	0.09	3,110	C.
August	544	59	156	.252	.29	9,590	B.
September	142	77	107	.173	.19	6,370	B.
October	130	59	89.2	.144	.17	5,480	C.
November	318	158	215	.347	.39	12,800	B.
December	11,600	237	1,440	2.32	2.68	88,500	B.
The period						126,000	
1908.							
January	2,690	760	1,300	2.10	2.42	79,900	B.
February	2,300	632	961	1.55	1.67	55,300	A.
March	1,920	700	997	1.61	1.86	61,300	A.
April	1,570	652	984	1.59	1.77	58,600	A.
May	1,010	652	783	1.26	1.45	48,100	A.
June	990	484	670	1.08	1.20	39,900	A.
July	460	88	260	.419	.48	16,000	C.
August	88	25	48.8	.079	.09	3,000	B.
September	119	33	61.8	.100	.11	3,680	A.
October	1,540	42	244	.394	.45	15,000	B.
November	2,000	142	481	.776	.87	28,600	A.
December	544	197	302	.487	.56	18,600	A.
The year	2,690	25	591	.954	12.93	428,000	

MISCELLANEOUS MEASUREMENTS IN ROGUE RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in Rogue River drainage basin during 1907 and 1908:

Miscellaneous measurements in Rogue River drainage basin in Oregon, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-feet.*
Nov. 14, 1908	Power canal of Rogue River Electric Co.		Gold Ray, near Tolo.		901
Sept. 19, 1908	Mill Creek	North Fork of Rogue River.	Prospect	(*a*)	63
July 16, 1907	Big Butte Creek	Rogue River	Butte Falls	*b* −13.11	222
Sept. 14, 1907	do	do	Near Derby	3.00	182
Oct. 30, 1907	do	do	do	.60	218
Sept. 12, 1908	do	do	do	(*a*)	257
Nov. 16, 1908	Antelope	Little Butte Creek	At mouth, near Eagle Point.	(*a c*)	1.5
July 10, 1907	Bear Creek	Rogue River	Ashland	*d* − 3.7	16
Do	Neil Creek	Bear Creek	do	(*c*)	2
Do	Emigrant Creek	do	Ashland, at mouth.	(*c*)	3
Do	Ashland Creek	do	Ashland, above diversions.		16
Sept. 10, 1907	do	do	do		9.3
Feb. 12, 1908	do	do	do	*e* − 3.4	12
May 11, 1908	do	do	do		26
Sept. 10, 1908	do	do	do	(*a*)	1.8
July 11, 1907	Wagner Creek	do	Talent, above diversions.		4.2
Sept. 10, 1907	do	do	do		2.4
Nov. 2, 1907	do	do	do		3.8
May 12, 1908	do	do	Talent, below diversions.		7.1
Sept. 10, 1908	do	do	do	(*a*)	.5

a Low water.
b Below top of downstream projecting floor beam of highway bridge 2 miles below forks, and 5 miles below Butte Falls.
c Estimated.
d Below bent 10-penny nail in alder, right bank, just above bridge at Eagle Mills.
e Below lower side of floor plank at center of bridge, downstream side.

UMPQUA RIVER DRAINAGE BASIN.

DESCRIPTION.

Umpqua River is formed by the junction of its North and South forks near the city of Roseburg in Douglas County, Oreg. The North Fork rises in Diamond Lake on the summit of the Cascade Mountains at an elevation of 5,300 feet and pursues a westward course. The South Fork is also formed by two forks—the northern rising in old Bailey Mountain about 4 miles south of Diamond Lake, and the southern on the northern slope of Abbot Butte, and the united waters flow westward and northward. From the junction of its principal forks, the Umpqua takes a tortuous but in general northerly course to Elkton, beyond which its course is more nearly westward until it debouches into the Pacific at Winchester Bay in the northwestern part of Douglas County. Its total drainage area comprises about 4,000 square miles. At Scottsburg, just above tide water, the area measures 3,070 square miles. The North Umpqua drains 1,080 and the South Umpqua 1,990 square miles. The important tributaries of the Umpqua are Smiths River, which drains the low mountainous area near the coast; Elk Creek, draining the divide between the Umpqua and Willamette basins; Cow Creek, which drains the divide between Rogue River and the Umpqua drainage; and the North and South forks.

The country is rough and mountainous, and the streams flow in comparative narrow valleys bordered by narrow stretches of agricultural land. The general elevation of the headwaters is 6,000 feet, with a few snow-capped peaks 8,000 to 10,000 feet high. As the elevation at Roseburg is 485 feet above sea level, it is apparent that the North Fork falls nearly 3,800 feet in the 75 miles from Diamond Lake to Roseburg by the river channel. The lower portion of the Umpqua has comparatively little fall, as is evidenced by the very winding character of the stream.

The region is one of the most densely forested in the United States, and probably 80 per cent of the drainage area can be classed as heavily forested. About one-fourth of the forest area is included in the national forests; the rest is owned by corporations and individuals.

The mean annual rainfall at Roseburg is 30 inches; at Drain, near the divide between the Willamette and Umpqua drainage, it is 48 inches. The mouth of the stream probably receives as much as 60 inches of this per annum, while at the headwaters the precipitation is 100 inches or more. Except on the headwaters all of this falls as rain during the nine months of the year from September to May.

Little or no irrigation has been practiced in the Umpqua Valley, although a few small ditches may be found on the smaller creeks of

the North and South forks. The agricultural products consist of grain and fruits. For the production of apples, prunes, and similar fruits, the climate and soil are especially well adapted. Although the possibilities for waterpower development in this area are almost phenomenal, there are no plants of importance.

There is a remarkable difference between the run-off of the North and South forks of the Umpqua which would have been very difficult to detect except through actual records of stream flow. The annual run-off of the North Fork is 4 second-feet per square mile while that of the South Fork is 1.6 second-feet per square mile. Since records have been kept, highest run-off values were shown in 1907. It is probable that 1905 was a year of low run-off, although the records do not cover that period.

The following gaging stations have been maintained in this drainage basin:

Umpqua River near Elkton (1906 to 1908).
North Fork of Umpqua River near Oak Creek and Winchester (1905 to 1908).
South Fork of Umpqua River near Brockway (1905 to 1908).
Mill Creek near Ash (1907 to 1908).

SOUTH FORK OF UMPQUA RIVER NEAR BROCKWAY, OREG.

This station was established December 6, 1905. It is located just below Winston's bridge, 6 miles south of Roseburg, 3 miles below the mouth of Lookingglass Creek, 10 miles below the mouth of Myrtle Creek, and 7 miles above the junction of the North and South forks of the Umpqua. Measurements were originally made from a cable, but this was destroyed by flood January 4, 1907, and since that date measurements have been made from the highway bridge. The datum of the gage has not been changed since it was established.

The conditions at this station are favorable for good results, and a permanent rating curve has been established. The ice conditions during the winter months do not cause interference, and the records are believed to be reliable.

The data obtained are of particular interest in studying the run-off conditions from forested areas under a high rainfall.

Discharge measurements of South Fork of Umpqua River near Brockway, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7	I. E. Oakes	290	1,200	3.50	2,710
September 30 [a]	E. F. Kriegsman	220	267	.25	215
December 14	C. E. Ellsworth	360	2,530	7.55	11,300
1908.					
November 8	H. D. McGlashan	244	405	.76	343

[a] Measured by wading.

Daily gage height, in feet, of South Fork of Umpqua River near Brockway, Oreg., for 1907 and 1908.

[George W. Brusi, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.5	10.2	4.4	5.75	2.65	1.7	0.85	0.25	0.25	0.4	0.75	2.35
2	4.2	13.1	4.5	5.6	2.55	1.7	.8	.25	.2	1.0	.9	2.2
3	4.3	14.5	4.4	5.0	2.5	1.65	.8	.25	.2	.9	1.0	2.0
4	24.0	19.3	4.15	4.65	2.5	1.55	.75	.2	.2	.7	.95	1.8
5	12.0	17.9	3.95	5.1	2.45	1.5	.75	.2	.2	.5	.85	2.15
6	8.0	13.5	3.7	6.35	2.4	1.45	.75	.2	.2	.4	.8	3.0
7	6.6	9.5	3.5	17.1	2.35	1.4	.7	.25	.2	.35	.75	3.05
8	5.5	7.85	3.4	10.9	2.3	1.35	.65	.3	.15	.3	.6	3.1
9	4.9	6.7	3.5	8.45	2.25	1.3	.65	.5	.15	.3	.5	3.3
10	4.5	6.1	3.35	7.7	2.25	1.3	.65	.7	.1	.25	.45	3.3
11	4.25	5.65	3.3	7.35	2.45	1.35	.65	.7	.1	.25	.35	4.3
12	4.15	5.2	3.25	6.65	2.5	1.75	.65	.65	.1	.2	.3	4.45
13	4.05	4.85	3.15	6.15	2.45	1.75	.6	.5	.15	.2	.3	9.3
14	3.7	4.6	3.05	5.75	2.3	1.8	.55	.4	.1	.2	.3	8.0
15	3.65	4.3	2.9	5.3	2.15	1.8	.5	.35	.1	.15	.6	5.6
16	3.5	4.05	2.9	4.9	2.1	1.8	.5	.35	.15	.15	.65	4.3
17	3.3	3.45	2.8	4.55	2.1	1.7	.5	.25	.15	.15	.7	3.8
18	3.15	3.35	11.5	4.2	2.1	1.6	.5	.25	.25	.1	.6	3.6
19	3.2	3.35	10.1	4.45	2.2	1.5	.5	.2	.25	.1	.6	3.6
20	3.15	3.3	13.0	4.0	2.5	1.45	.45	.2	.25	.1	.75	5.9
21	3.05	3.3	9.4	3.8	2.4	1.3	.4	.2	.15	.1	1.3	5.8
22	3.0	3.25	7.6	3.65	2.45	1.25	.4	.2	.15	.1	1.8	8.0
23	3.15	3.6	7.9	3.4	2.4	1.25	.4	.25	.15	.1	3.1	11.7
24	3.6	4.4	7.7	3.3	2.4	1.15	.35	.25	.15	.15	2.8	10.8
25	4.15	4.6	6.9	3.25	2.3	1.1	.3	.3	.1	.2	2.85	15.0
26	4.3	5.3	6.4	3.2	2.1	1.05	.3	.3	.1	.2	2.9	19.5
27	5.0	4.85	5.9	3.1	2.0	1.05	.3	.35	.1	.2	2.95	14.3
28	5.3	4.4	5.6	2.95	1.9	1.0	.3	.35	.1	.2	2.9	9.3
29	10.3	.....	5.4	2.85	1.8	.95	.25	.25	.15	.25	2.85	7.9
30	8.7	.....	5.4	2.75	1.8	.85	.25	.2	.15	.55	2.8	6.4
31	8.65	.....	5.65	.....	1.75	.....	.25	.2	.....	.7	.....	7.0
1908.												
1	7.2	3.1	4.85	3.85	2.65	2.15	1.5	.3	.1	.1	1.4	2.45
2	7.0	3.0	4.95	3.9	2.6	2.05	1.4	.3	.05	.1	1.3	2.3
3	7.3	3.0	4.1	3.9	2.55	2.1	1.35	.25	.05	.1	1.25	2.2
4	7.1	2.9	3.9	4.0	2.45	2.1	1.3	.25	.05	.1	1.15	2.15
5	5.7	2.8	3.8	3.95	2.4	2.0	1.25	.25	.05	.1	1.0	1.95
6	5.0	3.5	3.7	3.7	2.35	1.95	1.2	.25	.05	.1	.9	1.85
7	4.65	8.1	3.65	3.5	2.45	1.95	1.15	.2	.05	.1	.85	1.65
8	4.45	6.8	3.65	3.3	2.65	1.95	1.15	.2	.05	.0	.76	1.6
9	8.0	6.6	3.7	3.15	2.8	2.0	1.05	.2	.05	.0	.75	1.5
10	8.15	6.4	3.9	3.1	2.7	2.1	1.05	.2	.05	.0	.75	1.45
11	7.1	6.15	4.4	3.1	2.6	2.2	1.0	.2	.05	.0	.65	1.3
12	6.0	6.0	4.6	3.1	2.5	2.2	.95	.2	.05	.0	.6	1.3
13	5.65	5.8	4.7	3.15	2.4	2.1	.9	.15	.05	.0	.6	1.3
14	5.8	5.75	4.7	3.25	2.35	2.0	.85	.15	.05	.25	.55	2.05
15	6.65	5.65	4.75	3.25	2.45	1.9	.8	.15	.05	4.05	.55	2.15
16	6.0	5.45	5.6	3.25	3.0	1.85	.75	.15	.05	3.0	.5	2.1
17	5.9	5.15	6.5	3.3	3.2	1.8	.7	.15	.0	2.8	.5	1.95
18	5.75	4.9	6.2	3.35	3.15	1.7	.65	.15	.0	1.9	.6	1.75
19	5.65	4.7	5.4	3.25	3.9	1.7	.65	.1	.0	1.6	.85	1.65
20	7.0	4.65	4.95	3.2	3.7	2.0	.6	.1	.0	1.75	1.6	1.5
21	6.65	4.3	4.4	3.25	3.55	2.6	.6	.1	.0	2.65	3.0	1.75
22	6.0	3.75	4.1	3.15	3.4	3.1	.55	.1	.0	2.2	4.0	2.0
23	5.7	3.5	3.75	3.05	3.45	2.7	.55	.1	.0	2.0	4.7	2.6
24	5.0	3.45	3.65	3.0	2.55	2.3	.5	.1	.0	1.6	5.0	5.35
25	4.45	3.4	3.65	3.15	2.65	2.2	.5	.1	.0	1.5	4.5	4.7
26	4.1	3.35	3.6	3.25	2.6	1.9	.45	.1	.0	1.35	4.45	4.65
27	3.8	3.35	3.5	3.1	2.6	1.7	.4	.1	.0	1.25	3.7	4.65
28	3.6	3.65	3.4	2.9	2.45	1.7	.35	.15	.0	1.2	3.4	4.4
29	3.3	3.8	3.3	2.8	2.35	1.6	.35	.15	.0	1.1	2.9	5.45
30	3.25	.....	3.4	2.7	2.3	1.55	.35	.15	.0	1.0	2.5	4.85
31	3.15	.....	3.6	.....	2.35	.....	.3	.1	.....	1.5	.....	4.05

Rating table for South Fork of Umpqua River near Brockway, Oreg., for 1905 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	160	1.60	715	3.40	2,110	9.00	15,600
0.10	182	1.70	765	3.60	2,340	10.00	18,760
0.20	206	1.80	820	3.80	2,610	11.00	21,980
0.30	232	1.90	880	4.00	2,900	12.00	25,280
0.40	260	2.00	940	4.20	3,210	13.00	28,600
0.50	290	2.10	1,005	4.40	3,540	14.00	32,000
0.60	321	2.20	1,070	4.60	3,890	15.00	35,400
0.70	354	2.30	1,140	4.80	4,260	16.00	38,900
0.80	389	2.40	1,210	5.00	4,650	17.00	42,400
0.90	426	2.50	1,280	5.20	5,060	18.00	46,000
1.00	465	2.60	1,360	5.40	5,500	19.00	49,800
1.10	504	2.70	1,440	5.60	5,960	19.30	50,940
1.20	544	2.80	1,520	5.80	6,440	24.00	68,800
1.30	585	2.90	1,610	6.00	6,940		
1.40	627	3.00	1,700	7.00	9,610		
1.50	670	3.20	1,900	8.00	12,530		

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based upon 13 discharge measurements made during 1905 and 1908 and is well defined between gage heights 0.2 foot and 9.0 feet.

Monthly discharge of South Fork of Umpqua River near Brockway, Oreg., for 1907 and 1908.

[Drainage area, 1,800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	68,800	1,700	7,620	4.23	4.88	469,000	A.
February	50,900	1,950	11,200	6.22	6.48	622,000	A.
March	28,600	1,520	6,790	3.77	4.35	418,000	A.
April	42,800	1,480	6,640	3.69	4.12	395,000	A.
May	1,400	792	1,120	.622	.72	68,900	A.
June	820	408	639	.355	.40	38,000	A.
July	408	219	300	.167	.19	18,400	A.
August	354	206	238	.132	.15	14,600	A.
September	219	182	196	.109	.12	11,700	A.
October	465	182	238	.132	.15	14,600	A.
November	1,800	232	699	.388	.43	41,600	A.
December	51,700	820	9,820	5.46	6.30	604,000	A.
The year	68,800	182	3,790	2.11	28.29	2,700,000	
1908.							
January	13,000	1,850	6,500	3.61	4.16	400,000	A.
February	12,800	1,520	4,370	2.43	2.62	251,000	A.
March	8,240	2,000	3,490	1.94	2.24	215,000	A.
April	2,900	1,440	2,030	1.13	1.26	121,000	A.
May	2,750	1,140	1,520	.844	.97	93,500	A.
June	1,800	692	978	.543	.61	58,200	A.
July	670	232	403	.224	.26	24,800	B.
August	232	182	198	.110	.13	12,200	B.
September	182	160	166	.092	.10	9,880	B.
October	2,980	160	619	.344	.40	38,100	A.
November	4,650	290	1,220	.678	.76	72,600	A.
December	5,620	585	1,740	.967	1.11	107,000	A.
The year	13,000	160	1,940	1.08	14.62	1,400,000	

UMPQUA RIVER NEAR ELKTON, OREG.

This station was established October 18, 1905, by J. G. Kelley, of Portland, through whose courtesy the gage heights are made available. It is located at Smiths Ferry at the falls in the river 4 miles

above Elkton. No tributaries of importance are received by the river in the vicinity of the station, the nearest being Elk Creek, 3 miles downstream.

The data obtained here are valuable chiefly in connection with water-power development, but they are also of considerable scientific interest, in that they determine run-off factors for large areas heavily forested and under a high rainfall.

The conditions at the station are favorable for good results. The channel is fairly permanent. The banks are high and do not overflow, although the river is subject to enormous floods. The datum of the gage has not been changed since it was established, but the gage heights have not been observed with any degree of refinement.

Discharge measurements of Umpqua River near Elkton, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 11	L. R. Allen	365	1,560	0.07	1,340
1907.					
May 31	J. C. Stevens	380	2,400	2.09	3,920
September 28	E. F. Kriegsman	363	1,510	—.04	1,270
December 16	C. E. Ellsworth	407	3,800	5.40	12,600

Daily gage height, in feet, of Umpqua River near Elkton, Oreg., for 1907 and 1908.

[D. C. Higginbothom, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1						2.00	1.08			0.21	0.21	3.88
2						1.96	1.00			.29	.12	3.54
3						1.88	.92			.46	.33	3.21
4						1.71	.88			.38	.46	3.83
5						1.67	1.12			.29	.29	2.42
6						1.67	1.21		0.08	.21	.21	2.88
7						1.67	1.05	0.12	.17	.08	.12	3.12
8						1.67	.88	.29	.29		.05	3.29
9						1.67	.79	.38	.38			3.79
10						1.67	.62	.42	.46			4.25
11						1.75	.58	.33	.29			4.71
12					3.00	1.88	.50	.29	.17			6.12
13					2.88	2.25	.46	.25	.12			7.75
14					2.71	2.62	.42	.21	.08			15.00
15					2.54	2.46	.29	.17			.12	8.50
16					2.54	2.29	.21	.17			.29	5.75
17					2.50	2.17	.17	.08			.50	4.96
18					2.58	2.08	.17	.08			.33	4.17
19					2.62	1.96	.17	.08			.42	4.21
20					2.71	1.79	.08				.75	4.75
21					3.05	1.62	.08				2.00	5.33
22					2.79	1.54	.21				3.05	6.33
23					2.62	1.54	.17				3.21	10.67
24					2.58	1.46	.08				6.46	15.00
25					2.50	1.38	.08				5.50	14.50
26					2.42	1.33	.08		.12		5.08	24.00
27					2.33	1.25	.08		.29		4.79	21.50
28					2.33	1.25	.08		.46		4.62	15.00
29					2.25	1.17			.38		4.46	10.00
30					2.12	1.17			.21		4.17	6.50
31					2.05					.21		8.12

Daily gage height, in feet, of Umpqua River near Elkton, Oreg., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	9.42	3.12	4.33	4.17	3.21	2.54	1.96	0.17	.....	.....	1.08	3.00
2	8.92	3.00	6.25	4.58	3.21	2.75	1.79	.17	.....	.....	.92	2.00
3	8.50	2.71	5.42	4.79	3.46	2.92	1.71	.17	.....	.....	.71	1.00
4	8.17	3.05	5.08	4.58	3.62	2.62	1.54	.08	.....	.....	.67	1.00
5	7.08	3.42	4.58	4.12	3.29	2.46	1.38	.08	.....	.....	.62	2.50
6	6.38	3.67	4.08	4.00	3.12	2.38	1.25	.08	.....	.....	.38	4.50
7	8.00	8.88	3.67	3.71	3.00	2.21	1.25	.12	.....	.....	.33	7.00
8	11.17	9.50	3.38	3.54	3.05	2.12	1.17	.25	.....	.....	.33	5.67
9	11.33	8.42	3.12	3.38	3.21	2.21	1.08	.17	.....	.....	.29	5.21
10	9.83	7.33	3.58	3.21	3.33	2.38	1.00	.08	.....	.....	.25	5.05
11	9.33	7.05	4.08	3.33	3.12	2.58	1.00	.....	.....	.....	.17	4.54
12	8.75	6.71	5.12	3.54	3.05	2.79	1.00	.....	.....	.....	.17	4.25
13	6.88	6.54	5.83	3.71	2.88	2.96	.96	.....	.....	0.12	.17	4.21
14	6.42	6.29	6.58	3.83	2.75	2.83	.83	.....	.....	.29	.25	3.46
15	5.67	6.08	7.12	3.92	2.96	2.46	.75	.....	.....	.58	.38	3.08
16	6.33	5.54	7.71	4.05	3.17	2.29	.71	.....	.....	.88	.54	2.50
17	7.50	5.38	8.67	4.21	3.38	2.21	.62	.....	.....	1.42	.83	3.08
18	5.83	5.21	8.58	4.12	3.75	2.12	.54	.....	.....	5.00	2.50	3.42
19	5.54	5.33	7.83	3.71	4.21	2.05	.58	.....	.....	6.38	4.50	2.83
20	5.29	5.46	7.42	3.54	4.38	2.42	.50	.....	.....	6.17	6.00	2.42
21	5.12	5.21	7.05	3.38	4.54	2.83	.42	.....	.....	4.50	5.62	2.21
22	4.96	5.05	6.00	3.17	4.75	4.12	.42	.....	.....	2.00	6.08	2.00
23	4.79	4.58	4.50	3.38	4.96	3.62	.38	.....	.....	2.00	6.92	2.38
24	4.62	4.29	3.88	3.50	4.42	2.92	.33	.....	.....	1.88	6.38	2.62
25	4.46	4.05	3.92	3.83	3.25	2.62	.29	.....	.....	1.62	6.12	2.75
26	4.29	3.62	4.50	4.12	3.71	2.46	.25	.....	.....	1.50	5.58	3.54
27	4.12	3.46	4.79	3.83	3.54	2.38	.25	.....	.....	1.38	5.38	3.92
28	3.96	3.33	5.25	3.46	3.25	2.29	.25	.....	.....	1.29	5.25	4.83
29	3.79	3.21	5.21	3.33	3.05	2.12	.21	.....	.....	1.58	5.21	7.00
30	3.38	.....	4.42	3.29	2.88	2.00	.17	.....	.....	2.00	5.05	8.83
31	3.21	.....	3.88	.....	2.71	.....	.17	.....	.....	1.29	.....	5.00

NOTE.—The missing gage heights in period May 12, 1907, to December 31, 1908, were recorded by observer as 0.0, but they were probably below the zero of the gage most of this time.

Rating table for Umpqua River near Elkton, Oreg., for 1905 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	1,290	1.50	2,940	3.00	6,000	6.00	14,400
0.10	1,370	1.60	3,100	3.20	6,500	7.00	17,600
0.20	1,460	1.70	3,270	3.40	7,000	8.00	21,000
0.30	1,550	1.80	3,440	3.60	7,500	9.00	24,600
0.40	1,640	1.90	3,620	3.80	8,000	10.00	28,400
0.50	1,730	2.00	3,800	4.00	8,500	11.00	32,200
0.60	1,820	2.10	4,000	4.20	9,040	12.00	36,000
0.70	1,920	2.20	4,200	4.40	9,600	13.00	39,900
0.80	2,020	2.30	4,400	4.60	10,160	14.00	43,800
0.90	2,130	2.40	4,600	4.80	10,720	15.00	47,800
1.00	2,250	2.50	4,820	5.00	11,300	16.00	51.800
1.10	2,370	2.60	5,040	5.20	11,920	17.00	55,900
1.20	2,500	2.70	5,270	5.40	12,540	18.00	60,000
1.30	2,640	2.80	5,500	5.60	13,160	19.00	64,100
1.40	2,790	2.90	5,750	5.80	13,780		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906–7, and is well defined between gage heights 0.0 and 5.4 feet.

Monthly discharge of Umpqua River near Elkton, Oreg., for 1905 and 1908.

Month.	Discharge in second-feet.			Run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1905.					
October 18-31	1,970	1,350	1,630	45,300	C.
November [a]	3,580	1,150	1,580	94,000	C.
December	22,000	2,310	5,800	357,000	B.
1906.					
January	61,400	6,950	17,400	1,070,000	B.
February	49,300	4,820	16,000	889,000	B.
March	19,300	6,000	10,200	627,000	B.
April	18,700	5,200	8,310	494,000	B.
May	40,700	4,730	9,080	558,000	B.
June	15,300	3,730	8,420	501,000	B.
July	3,360	1,500	2,040	125,000	C.
August [b]	1,500	1,290	1,360	83,600	C.
September [b]	2,460	1,290	1,470	87,500	C.
October [b]	2,510	1,290	1,460	89,800	D.
November	18,200	1,290	6,270	373,000	C.
December	21,800	2,250	10,400	640,000	B.
The year	61,400	1,290	7,700	5,540,000	
1907.					
May 12-31	6,120	3,900	4,970	197,000	B.
June	5,090	2,460	3,400	202,000	C.
July [c]	2,510	1,290	1,690	104,000	D.
August [c]	1,660	1,290	1,370	84,200	D.
September [c]	1,690	1,290	1,390	82,700	C.
October [c]	1,690	1,290	1,350	83,000	C.
November [c]	15,900	1,290	4,190	249,000	B.
December	84,600	4,640	21,500	1,320,000	C.
1908. [d]					
January	33,500	6,520	16,600	1,020,000	B.
February	26,500	5,290	12,200	702,000	B.
March	23,400	6,300	12,600	775,000	B.
April	10,700	6,420	7,970	474,000	B.
May	11,200	5,290	7,170	441,000	B.
June	8,820	3,800	4,990	297,000	B.
July	3,730	1,430	2,100	129,000	D.
August 1-10 [d]	1,500	1,350	1,400	27,800	D.
October 13-31 [d]	15,600	1,390	4,880	184,000	C.
November	17,300	1,430	6,500	387,000	B.
December	24,000	2,250	8,250	507,000	B.

[a] Gage height recorded as 0.0 November 2 to 19; it was probably lower than this November 5 to 18; discharge for 9 to 18 estimated at 1,150 second-feet.
[b] Gage readings of 0.0 accepted, although the river probably went a little lower in early part of September.
[c] Gage heights of 0.0 have been accepted, although the river probably went somewhat lower in October.
[d] Discharges for August 11 to October 12 have not been computed, as the river was probably below the zero of the gage most of the time.

NOTE.—Owing to poor gage readings, the monthly discharges are liable to very large errors at low stages.

NORTH FORK OF UMPQUA RIVER NEAR OAKCREEK AND WINCHESTER, OREG.

This station was established September 6, 1905, at Dixon's farmhouse, 3 miles west of Oakcreek, 10 miles below the mouth of East Fork of North Fork, and 9 miles northeast of Roseburg. The observer moved away October 10, 1908, and on November 10 the station was moved to Winchester, at the Southern Pacific Railroad bridge, about 6 miles north of Roseburg and 6 miles above the

mouth of the stream. As no important tributaries enter between the old and new positions, the records are comparable.

The stream is subject to sudden floods, caused usually by "chinook" winds in the spring or fall, by which the snows on the headwaters of the stream are rapidly melted.

The records obtained at this point furnish data of considerable value in connection with water-power development and irrigation, for which the waters of the river will probably be used to some extent. The data have also much scientific value, as the studies of this stream and of South Fork afford some very interesting information concerning the run-off from forested areas.

The following measurement was made November 10, 1908: Width, 216 feet; area, 861 square feet; gage height, 1.86 feet; discharge, 1,270 second-feet.

Daily gage height, in feet, of North Fork of Umpqua River near Oakcreek, Oreg., for 1907.

[Ethel Dixon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.7	10.1	4.65	4.6	3.6	3.3	2.55	1.95	1.8	1.9	1.7	3.35
2	4.3	14.5	4.7	4.4	3.5	3.3	2.5	1.9	1.8	1.9	2.4	3.3
3	8.45	19.0	4.6	4.2	3.4	3.2	2.45	1.9	1.75	1.8	2.0	3.25
4	11.5	21.2	4.3	4.85	3.45	3.15	2.45	1.9	1.75	1.8	1.95	3.2
5	7.4	16.3	4.5	11.0	3.45	3.1	2.45	1.9	1.7	1.7	1.8	3.1
6	6.0	12.2	4.0	13.4	3.45	3.0	2.4	1.9	1.7	1.7	1.7	3.0
7	5.15	9.0	4.0	13.4	3.45	3.0	2.35	2.0	1.7	1.7	1.7	2.95
8	4.55	7.55	3.95	8.7	3.45	3.0	2.35	2.1	1.7	1.7	1.7	2.95
9	4.1	6.4	3.9	7.8	3.5	2.95	2.3	2.05	1.7	1.65	1.7	2.95
10	4.0	6.2	3.9	7.8	3.7	3.0	2.3	2.05	1.7	1.65	1.7	3.1
11	3.85	5.9	3.85	7.1	3.8	3.2	2.25	2.0	1.7	1.65	1.7	3.6
12	3.8	5.6	3.8	7.0	3.7	3.4	2.2	1.9	1.75	1.6	1.7	4.8
13	3.75	5.2	3.7	7.5	3.5	3.4	2.2	1.9	1.75	1.6	2.1	10.0
14	3.5	5.0	3.5	6.0	3.45	3.0	2.15	1.85	1.75	1.6	2.0	6.3
15	3.3	4.85	3.5	6.65	3.4	2.4	2.15	1.85	1.95	1.6	1.95	5.0
16	3.3	4.7	3.5	5.5	3.5	2.4	2.15	1.8	2.1	1.6	1.85	5.6
17	3.2	4.65	3.9	4.9	3.6	2.2	2.1	1.8	2.0	1.6	1.85	6.6
18	3.15	4.6	9.4	4.85	3.7	3.0	2.1	1.8	1.8	1.6	1.85	5.5
19	3.1	4.55	8.3	4.65	3.8	3.1	2.1	1.8	1.7	1.6	1.75	4.7
20	3.1	4.5	9.1	4.5	3.7	2.9	2.05	1.8	1.7	1.6	2.0	4.7
21	3.1	4.45	7.9	4.5	3.0	2.8	2.05	1.75	1.7	1.6	3.3	5.9
22	3.1	4.35	7.4	4.6	3.5	.....	2.0	1.75	1.65	1.6	3.5	17.7
23	3.1	4.2	7.0	4.6	3.45	.....	2.0	1.75	1.65	1.6	5.0	9.7
24	3.1	4.3	5.3	4.4	3.4	.....	2.0	1.8	1.65	1.6	7.6	16.2
25	4.1	4.45	5.0	4.3	3.4	.....	2.0	1.95	1.65	1.6	6.5	16.0
26	5.6	4.7	4.8	4.1	3.4	.....	2.0	1.9	1.7	1.6	5.8	16.5
27	6.2	4.55	4.4	4.0	3.45	.....	2.0	1.8	1.75	1.6	5.0	10.1
28	7.4	4.3	4.2	3.8	3.4	.....	2.0	1.75	1.8	1.6	4.5	8.5
29	10.75	.....	4.8	3.7	3.4	.....	2.0	1.75	1.8	2.0	3.7	6.7
30	8.7	.....	4.9	3.05	3.45	.....	1.95	1.75	1.8	1.9	3.35	5.8
31	9.3	.....	5.0	.....	3.3	.....	1.95	1.8	.....	1.7	...	6.0

Daily gage height, in feet, of North Fork of Umpqua River near Oakcreek, Oreg., for 1908.

[Robert Findley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	3.5	4.5	4.3	3.8	3.5	3.0	2.6	1.8	1.2	.....	.....
2	5.5	3.5	3.8	4.0	3.6	3.6	3.0	2.4	1.8	1.2	.....	.....
3	5.3	3.4	3.3	4.0	3.6	3.6	3.0	2.4	1.7	1.2	.....	.....
4	5.3	3.35	3.3	4.8	3.6	3.6	2.9	2.3	1.7	1.2	.....	.....
5	5.3	3.3	3.3	4.8	3.4	3.6	2.9	2.3	1.8	1.2	.....	.....
6	5.3	4.6	3.3	4.7	3.3	3.6	2.9	2.0	1.8	1.2	.....	.....
7	5.3	5.3	3.3	5.0	4.0	3.6	2.9	2.0	1.7	1.3	.....	.....
8	6.0	5.0	3.3	3.2	4.2	3.5	2.8	2.0	1.7	1.3	.....	.....
9	6.4	4.7	3.2	3.2	4.2	3.5	2.8	2.2	1.7	1.2	.....	.....
10	7.6	4.5	3.15	3.4	4.1	3.0	2.8	2.1	1.6	1.2	.....	.....
11	7.0	4.45	3.15	3.4	4.3	3.0	2.7	2.0	1.6	.....	.....	.....
12	6.7	4.35	3.2	3.7	4.2	3.0	2.7	2.0	1.6	.....	.....	.....
13	6.6	4.2	3.3	3.7	4.2	3.0	2.7	2.0	1.6	.....	.....	.....
14	6.5	4.1	3.3	3.8	4.2	3.0	2.7	2.0	1.6	.....	.....	.....
15	5.9	4.0	4.0	3.9	5.0	3.1	2.7	2.0	1.5	.....	.....	.....
16	5.3	3.9	4.6	3.9	5.1	3.1	2.5	2.2	1.5	.....	.....	.....
17	4.9	3.75	4.5	3.8	4.0	3.1	2.5	2.2	1.5	.....	.....	.....
18	4.5	3.7	4.0	3.8	4.1	3.0	2.5	2.1	1.5	.....	.....	.....
19	5.5	3.6	3.8	3.8	4.3	3.0	2.7	2.1	1.5	.....	.....	.....
20	6.1	3.5	3.6	4.0	4.6	3.4	2.9	2.0	1.5	.....	.....	.....
21	5.3	3.5	3.55	4.2	5.0	3.5	2.8	2.0	1.4	.....	.....	.....
22	4.5	3.4	3.4	4.3	4.8	3.9	2.8	2.0	1.4	.....	.....	.....
23	4.5	3.4	3.4	4.3	4.5	4.0	2.7	2.1	1.5	.....	.....	.....
24	4.5	3.4	3.3	4.3	4.2	3.5	2.7	2.1	1.5	.....	.....	.....
25	4.5	3.4	3.3	4.5	4.0	3.5	2.7	2.1	1.4	.....	.....	.....
26	4.0	3.4	3.3	4.5	3.3	3.3	2.5	2.0	1.4	.....	.....	.....
27	3.6	3.4	3.6	4.7	3.6	3.3	2.5	2.0	1.3	.....	.....	.....
28	3.5	3.3	4.05	4.7	3.6	.....	2.5	2.0	1.3	.....	.....	.....
29	3.5	5.0	4.5	4.8	3.5	.....	2.6	2.0	1.2	.....	.....	.....
30	3.5	.....	4.3	3.6	3.5	.....	2.5	1.7	1.2	.....	.....	.....
31	3.5	.....	4.15	.....	3.5	.....	2.5	1.7	.....	.....	.....	.....

Daily gage height, in feet, of North Fork of Umpqua River near Winchester, Oreg., for 1908.

[W. J. Pearson, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	.....	2.6	16	1.75	2.4
2	.....	2.5	17	1.7	2.35
3	.....	2.45	18	1.9	2.15
4	.....	2.35	19	2.9	2.1
5	.....	2.3	20	3.55	2.15
6	.....	2.25	21	4.8	2.2
7	.....	2.2	22	5.7	2.4
8	.....	2.2	23	5.05	3.0
9	.....	2.15	24	4.8	4.3
10	1.85	2.1	25	4.3	3.5
11	1.8	2.1	26	3.8	4.9
12	1.8	2.0	27	3.35	4.9
13	1.8	2.3	28	3.05	4.55
14	1.8	2.65	29	2.95	6.2
15	1.8	2.5	30	2.75	4.65
			31	.....	3.95

Rating table for North Fork of Umpqua River near Oakcreek, Oreg., for 1905 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	800	2.90	2,360	4.60	5,300	7.60	12,390
1.30	860	3.00	2,500	4.70	5,510	7.80	12,930
1.40	920	3.10	2,640	4.80	5,720	8.00	13,470
1.50	985	3.20	2,780	4.90	5,930	9.00	16,300
1.60	1,055	3.30	2,930	5.00	6,150	10.00	19,300
1.70	1,130	3.40	3,080	5.20	6,590	11.00	22,300
1.80	1,205	3.50	3,240	5.40	7,040	12.00	25,500
1.90	1,285	3.60	3,410	5.60	7,500	13.00	28,800
2.00	1,370	3.70	3,580	5.80	7,960	14.00	32,300
2.10	1,460	3.80	3,760	6.00	8,420	15.00	35,800
2.20	1,550	3.90	3,940	6.20	8,900	16.00	39,300
2.30	1,650	4.00	4,130	6.40	9,380	17.00	42,900
2.40	1,750	4.10	4,320	6.60	9,860	18.00	46,600
2.50	1,860	4.20	4,510	6.80	10,340	19.00	50,300
2.60	1,980	4.30	4,700	7.00	10,830	20.00	54,000
2.70	2,100	4.40	4,900	7.20	11,340	21.00	57,800
2.80	2,230	4.50	5,100	7.40	11,860	22.00	61,800

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based upon 10 discharge measurements made during 1905–6 and is well defined between gage heights 1.3 feet and 7.0 feet.

Monthly discharge of North Fork of Umpqua River near Oakcreek, Oreg., for 1907 and 1908.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	23,900	2,640	7,030	7.03	8.10	432,000	A.
February	58,600	4,510	13,400	13.4	13.95	744,000	B.
March	71,500	3,240	6,490	6.49	7.48	399,000	A.
April	30,200	2,570	9,000	9.00	10.04	536,000	A.
May	3,760	2,500	3,240	3.24	3.74	199,000	A.
June[a]	3,080	1,550	2,380	2.38	2.66	142,000	A.
July	1,920	1,330	1,540	1.54	1.78	94,700	A.
August	1,460	1,170	1,260	1.26	1.45	77,500	A.
September	1,460	1,090	1,170	1.17	1.30	69,600	A.
October	1,370	1,060	1,110	1.11	1.28	68,200	A.
November	12,400	1,130	2,840	2.84	3.17	169,000	A.
December	45,500	2,430	11,600	11.6	13.37	713,000	A.
The year	71,500	1,060	5,090	5.09	68.32	3,640,000	
1908.							
January	12,400	3,240	6,740	6.74	7.77	414,000	A.
February	6,810	2,930	3,990	3.99	4.30	230,000	A.
March	5,300	2,710	3,520	3.52	4.06	216,000	A.
April	6,150	2,780	4,360	4.36	4.86	259,000	A.
May	6,370	2,930	4,250	4.25	4.90	261,000	A.
June	4,130	2,500	3,020	3.02	3.37	180,000	A.
July	2,500	1,860	2,140	2.14	2.47	132,000	A.
August	1,980	1,130	1,450	1.45	1.67	89,200	A.
September	1,200	800	1,020	1.02	1.14	60,700	A.
October 1–11	860	800	811	.811	.33	17,700	A.
The period						1,860,000	

[a] Discharges interpolated June 22 to 30.

MILL CREEK NEAR ASH, OREG.

This station was established May 29, 1907. It is located at the outlet of Loon Lake, in the lower Umpqua River drainage area. Measurements are made by wading just below the outlet of the lake, and the

gage heights used in determining the discharge are those observed in the lake on the south shore, one-half mile above the outlet.

The data are of value chiefly in connection with the development of water power. The stream has a heavy grade below the station, and Loon Lake offers a possible site for storage. The gage heights have been furnished by J. G. Kelley, of Portland.

Discharge measurements of Mill Creek near Ash, Oreg., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 29	J. C. Stevens	50	97	4.70	85.0
September 26	E. F. Kriegsman	16	13	2.85	5.1

Daily gage height, in feet, of Mill Creek near Ash, Oreg., for 1907 and 1908.

[John Salander, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1						4.5	3.8					6.6
2						4.5					3.1	6.3
3												6.1
4								3.2				6.0
5												6.3
6												6.4
7							3.7					6.6
8								3.2				6.9
9						4.1					3.5	7.0
10												6.9
11								3.2				7.9
12										3.2		8.8
13						4.7		3.2				9.8
14						4.8						11.0
15						4.8	3.5		2.7	3.0	3.4	9.9
16						4.6		3.1				8.8
17												8.0
18					4.7					2.9	3.5	7.8
19					4.7						3.6	7.3
20											4.2	8.5
21							3.4				6.3	9.5
22									2.8		6.4	12.5
23						4.1		2.9			6.7	13.0
24											8.5	11.6
25											9.7	13.4
26									2.85	2.8	9.0	15.5
27											8.8	13.4
28							3.3					11.9
29					4.7							10.1
30					4.6						6.8	
31					4.55							
1908.												
1	9.5	6.0	7.4	7.3	5.3	5.25		3.38	3.0			5.9
2	9.7	5.95	8.5	7.4	5.3	5.2	4.3	3.38	3.0			5.8
3	9.3	5.85	8.6	7.2	5.7	5.15		3.38				5.6
4	8.8	6.0	8.3	7.0	6.35	5.1		3.3				5.5
5	8.4	6.35	8.0	6.7	6.4	5.05	4.1	3.25				5.3
6	8.1	7.0	7.5	6.5	6.1		4.1			2.6		5.25
7	7.7	8.2	7.3	6.4	6.0		4.05		2.9			5.2
8	7.5	8.1	7.1	6.4	5.9	4.85		3.2	2.9	2.6		5.05
9	7.9		6.9	6.2	5.8	4.8			2.9			5.0
10	8.1	7.2		6.05	5.7				2.9		4.0	5.0

Daily gage height, in feet, of Mill Creek near Ash, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	8.1	7.2	6.7	5.9	5.5	.....	.....	.....	.....	2.4	3.95	4.9
12	7.7	7.15	.....	.....	5.4	.....	3.9	3.1	.....	.....	3.9	4.85
13	7.5	7.1	6.5	5.7	5.45	4.5	.....	.....	.....	.....	3.85	5.3
14	7.3	7.0	6.4	5.6	5.35	.....	.....	.....	.....	.....	3.8	6.0
15	7.1	6.9	6.4	5.6	5.35	.....	3.7	3.05	2.9	5.3	3.75	6.45
16	6.9	6.85	6.6	5.55	5.4	4.4	3.7	3.05	.....	6.0	.....	6.5
17	6.8	7.0	6.8	.....	5.5	4.35	3.7	3.02	.....	6.0	.....	6.4
18	6.7	7.0	6.9	5.5	5.9	4.35	3.7	3.02	2.85	.....	.....	6.3
19	6.7	6.9	6.8	5.5	6.3	4.35	3.7	3.02	.....	.....	.....	6.2
20	7.3	6.8	6.7	5.4	.....	4.4	3.68	3.02	.....	.....	4.6	5.95
21	8.1	6.7	6.5	5.3	6.6	5.0	3.62	3.0	.....	.....	5.7	5.9
22	8.0	6.55	6.35	5.2	6.4	5.0	3.6	3.0	.....	.....	6.6	5.9
23	7.6	6.35	.....	5.1	6.3	5.0	3.6	3.0	.....	4.8	7.6	6.5
24	7.3	6.3	6.4	5.55	6.2	4.9	3.55	2.98	2.7	.....	8.35	9.0
25	7.0	6.2	6.4	6.2	6.0	4.8	.....	2.98	.....	.....	8.1	8.25
26	6.9	6.1	.....	6.2	5.8	4.7	3.5	2.95	.....	.....	7.6	9.05
27	6.65	6.0	.....	6.0	.....	4.65	3.5	2.95	2.68	.....	7.2	9.1
28	6.45	6.0	6.85	5.9	5.6	4.6	.....	2.95	.....	4.0	6.8	.....
29	6.35	6.4	6.8	5.7	5.45	4.5	3.48	2.9	.....	3.95	6.5	.....
30	6.3	.....	6.8	5.55	5.4	4.4	3.45	3.0	.....	.....	6.2	8.75
31	6.1	.....	6.9	.....	5.3	.....	3.4	3.0	.....	4.5	.....	8.3

SILETZ RIVER DRAINAGE BASIN.

DESCRIPTION.

Siletz River rises in the mountains in the western part of Polk County, Oreg., at an elevation of about 3,000 feet above sea level, flows in a general southwesterly direction to Siletz, in Lincoln County, and thence winds tortuously northward and westward until it enters the Pacific Ocean through Siletz River Bay, about 6 miles northwest of Kernville. Its total length is approximately 50 miles, and its drainage area measures about 320 square miles.

Its basin is densely timbered throughout, although some areas of logged-off lands may be found on the lower reaches of the stream.

The mean annual rainfall at the mouth of the river is 75 or 80 inches; at the headwaters it is undoubtedly as high as 150 inches. The annual run-off shows about 9 second-feet per square mile of drainage area. The records thus far show very little variation in the total run-off of this drainage area, but it is probable that 1905 would be classed as a dry year, while 1906 may safely be considered a wet year.

Only one station has been maintained in this basin—that at Siletz (1905 to 1908).

SILETZ RIVER AT SILETZ, OREG.

This station, which was established November 25, 1905, is located at Siletz Ferry, 9 miles north of Toledo, 6 miles below the mouth of Rock Creek.

The data obtained at this station are chiefly of scientific interest, as the river is fairly typical of the short streams draining the western slope of the Coast Range and the run-off factors obtained here are doubtless applicable to other streams similarly located.

The gage datum has not been changed since the gage was established, and the records for the medium and low stages are reliable. The stream is subject to sudden and violent floods, but as the station is somewhat inaccessible, it has been impossible up to the present time to obtain measurements during flood periods. The estimates for such periods have, therefore, been made by an extension of the discharge curve, a method which appears to be legitimate, as the stream is entirely confined within its banks at the gaging section.

Discharge measurements of Siletz River at Siletz, Oreg., in 1905, 1906, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 26	L. R. Allen	157	394	2.15	1,17
1906.					
February 9	L. R. Allen	156	338	1.77	810
March 29	do	157	370	2.03	1,030
May 10	do	157	303	1.50	492
July 23	do	151	231	[a]1.23	309
September 24	I. E. Oakes	155	289	1.60	592
1908.					
February 8	H. D. McGlashan	163	660	3.75	3,280

[a] Small dam 75 feet below station may effect gage height a few hundredths foot.

Daily gage height, in feet, of Siletz River at Siletz, Oreg., for 1907 and 1908.

[John Kentta, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.8	7.6	3.0	2.9	1.7	1.3	1.15	0.9	0.8	2.0	1.5	4.0
2	3.2	5.3	2.9	2.8	1.65	1.25	1.1	.9	.8	2.0	1.5	3.4
3	13.55	6.2	2.8	2.8	1.6	1.25	1.1	.9	.8	2.0	1.45	3.0
4	13.2	9.0	2.7	2.9	1.6	1.25	1.1	.9	.8	1.95	1.4	2.75
5	7.2	16.9	2.6	3.2	1.55	1.25	1.1	.9	.75	1.95	1.4	3.3
6	5.1	10.3	2.5	5.0	1.55	1.25	1.05	.9	.75	1.95	1.35	3.0
7	3.9	6.8	2.45	11.5	1.5	1.2	1.05	.9	.75	1.95	1.35	3.6
8	3.4	5.2	2.4	7.6	1.5	1.2	1.05	1.0	.75	1.9	1.3	3.4
9	3.0	4.3	2.3	5.3	1.5	1.2	1.05	1.0	.75	1.9	1.3	3.1
10	2.7	3.9	2.8	4.7	1.55	1.3	1.05	1.0	.7	1.9	1.25	3.3
11	2.55	3.6	2.7	3.8	1.65	1.6	1.0	.95	.7	1.85	1.2	4.6
12	2.45	3.2	2.6	3.35	1.7	1.6	1.0	.95	.7	1.85	1.2	6.1
13	2.3	2.9	2.5	3.1	1.7	1.6	1.0	.9	.7	1.7	1.2	12.0
14	2.2	2.7	2.4	2.8	1.65	1.6	1.0	.9	.9	1.7	1.2	9.2
15	2.1	2.5	2.4	2.65	1.65	1.55	1.0	.9	1.5	1.65	1.3	6.1
16	2.0	2.3	2.4	2.4	1.6	1.5	1.0	.9	1.5	1.65	1.3	4.1
17	1.95	2.2	2.6	2.35	1.6	1.5	1.0	.85	1.5	1.6	1.25	3.5
18	1.9	2.1	2.7	2.7	1.55	1.45	.95	.85	1.45	1.6	1.25	3.8
19	1.9	2.0	2.6	2.6	1.5	1.4	.95	.85	1.45	1.55	1.7	3.0
20	1.85	1.9	2.5	2.5	1.5	1.4	.95	.85	1.45	1.55	2.6	4.8
21	2.2	1.85	2.5	2.4	1.45	1.35	.95	.8	1.4	1.5	3.2	8.85
22	2.3	1.8	2.4	2.35	1.4	1.3	.95	.8	1.4	1.5	4.8	13.0
23	2.3	1.7	2.6	2.3	1.4	1.3	.95	.8	1.4	1.45	6.35	9.2
24	2.2	2.1	2.5	2.2	1.35	1.25	.95	.85	1.4	1.45	16.4	9.9
25	2.1	2.7	2.7	2.1	1.35	1.25	.95	.9	1.4	1.4	12.5	6.7

Daily gage height, in feet, of Siletz River at Siletz, Oreg., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	2.0	2.7	2.6	2.0	1.35	1.2	0.95	0.9	1.35	1.35	9.0	10.5
27	2.0	2.75	2.6	1.9	1.35	1.2	.9	.9	1.6	1.35	5.8	7.8
28	2.5	2.85	2.6	1.85	1.3	1.2	.9	.85	1.8	1.3	4.7	5.4
29	2.2	.....	2.8	1.8	1.3	1.2	.9	.85	1.75	1.35	5.7	4.5
30	3.2	.....	2.7	1.75	1.3	1.15	.9	.85	1.75	1.35	5.0	3.8
31	6.7	.....	3.0	.....	1.3	.....	9	.85	.....	1.5	.....	3.4
1908.												
1	5.5	2.3	2.5	2.45	2.3	2.0	1 45	1.05	1.3	.8	3.2	2.3
2	4.6	2.15	2.7	2.45	2.25	1.9	1.4	1.0	1.2	.8	3.0	2.15
3	4.5	2.05	2.6	2.4	3.1	1.85	1.4	1.0	1.15	.8	2.7	2.1
4	4 5	4.2	2.5	2.4	2.8	1.8	1.35	1.0	1.1	.8	2.4	2.0
5	4.5	5.3	2.4	2.4	2.6	1.75	1.35	1.0	1.1	.8	2.2	1.9
6	4.4	7.2	2.3	2.35	2.45	1.7	1.35	1.0	1.05	.75	2.0	1.8
7	3.9	4.95	2.2	2.35	2.35	1.65	1.3	1.0	1.05	.75	1.9	1.7
8	4.6	3.8	2.15	2.3	2.3	1.6	1.3	.95	1.1	.75	1.85	1.65
9	4.9	3.35	2.1	2.3	2.25	1.6	1.3	.95	1.1	.75	1.8	1.6
10	4.5	3.0	2.1	2.3	2.2	1.55	1.3	.95	1.05	.75	1.65	1.55
11	4.3	2.8	2.05	2.25	2.1	1.5	1.25	.95	1.05	.75	1.6	1.5
12	3.9	2.7	2.0	2.25	2.15	1.5	1.25	1.0	1.05	.75	1.5	1.5
13	3.5	2.6	2.6	2.2	2.1	1.5	1.25	1.0	1.0	.9	1.5	2.1
14	3.2	2.5	5.3	2.2	2.0	1.4	1.25	1.0	1.0	3.2	1.45	1.9
15	3.0	2.45	21.65	2.2	2.2	1.4	1.2	1.0	1.0	3.0	1.4	1.8
16	2.7	2.4	12.8	2.2	2.8	1.35	1.2	1.0	.9	2.9	1.4	1.7
17	3.8	2.6	8.5	3.0	3.0	1.35	1.2	.95	.9	2.9	1.5	1.65
18	3.1	2.55	5.8	6.8	3.0	1.6	1.2	.95	.9	2.8	3.5	1.7
19	4.3	2.45	4.0	4.2	2.9	1.7	1.2	.95	.9	2.7	2.7	1.65
20	4.9	2.4	3.4	3.4	2.7	1.65	1.15	.95	.9	2.6	3.0	1.6
21	4.1	2.35	2.9	2.9	2.5	1.6	1.15	.9	.85	2.55	4.8	1.6
22	3.7	2.3	2.75	3.1	2.5	1.55	1.15	.9	.85	2.5	6.8	4.9
23	3.5	2.3	2.6	3.8	2.4	1.5	1.15	.9	.85	2.5	7.5	3.1
24	3.2	2.5	2.5	6.5	2.3	1.5	1.1	.9	.85	2.45	5.5	2.6
25	2.9	2.6	2.8	4.7	2.3	1.5	1.1	.85	.85	2.4	4.2	3.7
26	2.7	2.5	2.7	3.9	2.4	1.55	1.1	.85	.85	2.35	3.4	4.9
27	2.55	2.6	2.8	3.1	2.35	1.55	1.1	.85	.8	2.3	3.0	6.9
28	3.0	2.6	2.7	2.7	2.3	1.5	1.1	1.1	.8	2.25	2.75	7.8
29	2.8	2.6	2.7	2.5	2.2	1.5	1.05	1.4	.8	2.4	2.55	6.0
30	2.6	.....	2.8	2.35	2.15	1.45	1.05	1.4	.8	2.5	2.4	4.5
31	2.45	.....	2.9	.....	2.1	.....	1.05	1.35	.....	4.9	.....	3.6

Rating table for Siletz River at Siletz, Oreg., for 1905 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	83	2.30	1,320	3.90	3,410	7.00	8,630
0.80	113	2.40	1,430	4.00	3,560	8.00	10,620
0.90	150	2.50	1,550	4.20	3,860	9.00	12,700
1.00	190	2.60	1,670	4.40	4,160	10.00	14,940
1.10	237	2.70	1,790	4.60	4,480	11.00	17,300
1.20	289	2.80	1,920	4.80	4,800	12.00	19,760
1.30	349	2.90	2,050	5.00	5,120	13.00	22,440
1.40	417	3.00	2,180	5.20	5,460	14.00	25,300
1.50	498	3.10	2,310	5.40	5,800	15.00	28,300
1.60	585	3.20	2,440	5.60	6,130	16.00	31,400
1.70	680	3.30	2,570	5.80	6,470	17.00	34,500
1.80	782	3.40	2,710	6.00	6,810	18.00	37,600
1.90	887	3.50	2,850	6.20	7,170	19.00	40,700
2.00	992	3.60	2,990	6.40	7,540	20.00	43,800
2.10	1,100	3.70	3,130	6.60	7,900	21.00	46,900
2.20	1,210	3.80	3,270	6.80	8,270	22.00	50,000

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1905–1908, and is well defined between gage heights 1.2 feet and 4.0 feet. The extreme low and high water discharges are only approximate.

Monthly discharge of Siletz River at Siletz, Oreg., for 1905 to 1908.

[Drainage area, 220 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
November 26-30	2,440	992	1,460	6.64	1.23	14,500	A.
December	10,200	992	3,620	16.5	19.02	223,000	B.
1906.							
January	10,800	1,670	3,740	17.0	19.60	230,000	B.
February	10,400	498	3,400	15.5	16.14	189,000	B.
March	2,990	782	1,360	6.18	7.12	83,600	A.
April	1,380	498	895	4.07	4.54	53,300	A.
May	1,730	498	975	4.43	5.11	60,000	A.
June	3,710	782	1,600	7.27	8.11	95,200	A.
July	1,100	264	462	2.10	2.42	28,400	A.
August	264	132	187	.850	.98	11,500	B.
September	992	132	343	1.56	1.74	20,400	A.
October	3,560	417	1,380	6.27	7.23	84,800	A.
November	33,300	992	7,520	34.2	38.16	447,000	C.
December	22,200	992	4,130	18.8	21.67	254,000	B.
The year	33,300	132	2,170	9.85	132.82	1,560,000	
1907.							
January	24,000	834	3,500	15.9	18.33	215,000	B.
February	34,200	680	4,760	21.6	22.49	264,000	B.
March	2,180	1,320	1,680	7.64	8.81	103,000	A.
April	18,500	731	2,810	12.8	14.28	167,000	A.
May	680	349	509	2.31	2.66	31,300	A.
June	585	263	382	1.74	1.94	22,700	A.
July	263	150	190	.864	1.00	11,700	B.
August	190	113	146	.664	.77	8,980	C.
September	782	83	320	1.45	1.62	19,000	A.
October	992	349	666	3.03	3.49	41,000	A.
November	32,600	289	3,750	17.0	18.97	223,000	B.
December	22,400	1,860	6,670	30.3	34.93	410,000	B.
The year	34,200	83	2,120	9.61	129.29	1,520,000	
1908.							
January	5,960	1,490	3,250	14.8	17.06	200,000	B.
February	9,020	1,050	2,240	10.2	11.00	129,000	A.
March	48,900	992	4,480	20.4	23.52	275,000	B.
April	8,270	1,210	2,280	10.4	11.60	136,000	A.
May	2,310	992	1,470	6.68	7.70	90,400	A.
June	992	383	580	2.64	2.94	34,500	A.
July	458	214	304	1.38	1.59	18,700	A.
August	417	132	197	.895	1.03	12,100	B.
September	349	113	183	.832	.93	10,900	B.
October	4,960	98	1,130	5.14	5.93	69,500	A.
November	9,620	417	2,190	9.95	11.10	130,000	A.
December	10,200	498	2,130	9.68	11.16	131,000	A.
The year	48,900	98	1,700	7.75	105.56	1,240,000	

COLUMBIA RIVER DRAINAGE BASIN.

DESCRIPTION.

Columbia River has its source in Columbia Lake, in the eastern division of the Kootenai district, in British Columbia. From Columbia Lake it flows north to the fifty-second parallel of latitude, turns abruptly southward, nearly paralleling its former course, flows through a series of narrow lakes, and crosses the international boundary line near the northeast corner of the State of Washington, where it receives Clark Fork. After traversing Washington in a general

southerly direction, it turns westward and forms the boundary lines between Washington and Oregon, and empties into Pacific Ocean at the forty-sixth parallel of latitude.

The total drainage area of the Columbia is estimated from the best available maps to be 259,000 square miles, divided as follows:

	Square miles.
Oregon	55,370
Washington	48,000
Idaho	81,380
Montana	25,000
Nevada	5,280
Wyoming	5,270
British Columbia	38,700

This area is limited on the west by the Rocky Mountains and is traversed north and south by the Cascade and Coast ranges. Between the mountain ranges are rolling, rough, and mountainous table lands. Mean altitudes range from sea level near the mouth of the river, to 8,000 feet in the Rocky Mountains, 5,000 feet in the Cascade Range, 1,000 to 4,000 feet in the intervening table lands. Many peaks in the mountain ranges extend into the region of eternal snow, the highest in the Cascade Range, including Mount Baker (10,827 feet), Mount Rainier (14,380 feet), Mount Adams (12,307 feet), Mount Hood (11,225 feet), and Mount Jefferson (10,200 feet).

The principal tributaries of the Columbia River from source to mouth are listed in the following table:

Principal tributaries of the Columbia River.

From the west and north.	From the east and south.
Kettle River.	Kootenai.
San Poil.	Pend Oreille (Clark Fork).
Okanogan.	Colville River.
Methow.	Spokane River.
Chelan.	Snake (Lewis Fork).
Entiat.	Walla Walla.
Wenatchie.	Umatilla.
Yakima.	Willow Creek.
Klickitat.	John Day River.
White Salmon.	Deschutes.
Lewis.	Hood.
Kalama.	Willamette.
Cowlitz.	

The river is navigable in long stretches throughout its course in the United States, but owing to rapids and falls continuous navigation is not possible in the natural condition of the river. The navigable waters of the Columbia and its tributaries aggregate a total of 2,136 miles, distributed as follows:

Navigable waters of Columbia River and tributaries.[a]

	Miles.
From the ocean to mouth of Willamette River	102
Mouth of Willamette to The Dalles, 88 miles; to Big Eddy	92
Big Eddy to Celilo, obstructed for 9 miles	
* Celilo to Priest Rapids	198
Foot of Priest Rapids to head of rapids, obstructed 11½ miles	
* Head of Priest Rapids to Wenatchee	57
Wenatchee to mouth of Okanogan River	68
Mouth of Okanogan to Spokane Rapids, navigable at great risk only, a distance of 109 miles	
* Spokane Rapids to Rickey's landing	56
Rickey's landing to Marcus, Wash., not navigable 11 miles	
Marcus to Robson, B. C	63
Robson to Arrowhead Landing, B. C	124
Total navigable waters, main stream	760

SNAKE RIVER.

* Mouth to Riparia	67
Riparia to Lewiston	73
* Lewiston to Grande Ronde River	25
Grande River to Ballard's landing, obstructed 175 miles	
* Ballard's landing to Huntington	75
Total navigable waters, Snake River	240

WILLAMETTE RIVER AND TRIBUTARIES.

Mouth to Corvallis	118
* Corvallis to Eugene	53
* Tualatin River, mouth to head of navigation	25
Yamhill River, mouth to McMinnville	18
* Long Tom River, mouth to head of navigation	10
Total navigable waters, Willamette and tributaries	224

OTHER TRIBUTARIES OF COLUMBIA RIVER.

Clatskanie River, navigable on tide above mouth	3
Lewis River, mouth to La Center	7
Cowlitz River, mouth to point 10 miles above Toledo	40
Lake Chelan, Lakeside, at foot of lake, to Stehekin	50
Clark Fork and Lake Pend Oreille, Lakeview to Box Canyon	116
Box Canyon to Metaline, navigable at high water at great risk only, a distance of 6 miles	
Cœur d'Alene Lake, Cœur d'Alene City to head of lake	24
Cœur d'Alene River, mouth to Mission Landing	32
Upper and Lower Kootenai rivers, Golder, B. C., to Jennings, Mont	259
Jennings to Bonners Ferry, not navigable, 75 miles	
Bonners Ferry to head of Kootenai Lake	239

[a] Parts of the Columbia and its tributaries marked with asterisk are navigable under favorable conditions. Practically all these stretches of river can be made navigable at all seasons of the year at comparatively small expense. The Columbia and Snake Rivers were formerly navigated throughout the year, except during occasional blockades from ice, from Celilo to Lewiston. It will be noted that part of Snake River, from mouth to Riparia, is now marked "navigable under favorable conditions."

	Miles.
Nelson to mouth at Robson, 25 miles, not navigable	
* Okanogan River, mouth to international boundary	87
International Boundary to Penticton, 37 miles, not navigable	
Penticton to Okanogan Landing	55
Total navigable waters, other tributaries	912

The improvement of this river system for navigation is being carried on as rapidly as funds will permit. The work at present under way consists, briefly, of the deepening of the mouth of the Columbia River through the construction of jetties. In 1907 the Columbia bar had a navigable depth of approximately 26 feet at low tide; it is expected that when projects now under way are completed a depth of 40 feet may, if necessary, be obtained. The opening of the Cascade locks and canals to traffic in 1906 rendered the river navigable in one unit from the mouth to Big Eddy. When the projected locks and canal have been constructed around the obstructions between Celilo and Big Eddy, a distance of about 8½ miles, the Columbia will be open to steamboat navigation from Priest Rapids to the sea—a distance of 400 miles.

The area drained by the Columbia includes perhaps the largest consolidated area of forests in the world. Originally almost the entire area, except those arid portions midway between the mountain ranges, was covered with dense forests, and although the territory has been settled for about sixty-five years and large areas have been cleared, the percentage of forested area to the entire area has been reduced but slightly. It is believed that at least 45 per cent (about 11,600 square miles) of the drainage area of Columbia River is forested, and that about 5,800 square miles contain merchantable timber.

The rainfall is distributed over the area most irregularly. From the Pacific coast eastward to the summit of the Coast Range the mean annual rainfall varies from 100 to 150 inches. In the basins between the Coast and Cascade ranges, it drops to about 40 inches per annum. It increases again to about 100 inches on the summit of the Cascade Range, and decreases very rapidly to beyond the summit, until at the eastern base of the Cascades it has dropped to about 14 inches. At the mouth of Snake River the mean annual rainfall is about 9 inches, but this extremely low rainfall obtains only in the lower altitudes. Beyond this point the rainfall again increases in Washington and northern Idaho to about 20 inches, while in eastern Oregon it continues at about 9 inches or less. In the eastern areas a large proportion of precipitation appears as snow, and during the winter months the streams are more or less icebound. West of the Cascade Range, however, ice conditions during the winter months are not encountered.

The climate of the area exhibits all the variations from the rigorous climate of the northern latitudes, as found in British Columbia and the higher table-lands of Oregon and Idaho, to the mild climate of western Oregon and Washington.

As regards irrigation, the area ranges from the extremely arid region, where irrigation is absolutely essential, through the semi-arid country, where dry farming and irrigation are practiced side by side, to the humid country that, strictly speaking, is arid in the summer months.

In the Willamette Valley, for instance, where the mean annual rainfall is approximately 40 inches, only 5 per cent of this amount is received during the growing season, and the fullest agricultural development will not be realized until this entire portion of the area is brought under irrigation as completely as are the arid portions beyond the mountains. The irrigated areas of the Pacific Northwest are being extended so rapidly that it is almost impossible to keep pace with the development, and yet, comparatively speaking, a very small portion of the irrigable area has been developed. At present 1,500,000 acres of land are under irrigation in the Northwest, and this area will be more than doubled when projects now being constructed are completed. The values of irrigated agricultural lands vary from about $30 per acre for the poorest qualities of hay lands to $3,000 per acre for the intensely cultivated orchards.

Columbia River and its tributaries afford at least one-third of the available water powers in the entire United States, but developments along this line have scarcely begun. About 250,000 horsepower are at present developed by water power in Oregon, Washington, and Idaho.

Lumbering has been the principal industry of the Northwest, and the streams of the country have therefore been used not only for water-power development but for the transportation of logs from the timbered mountain slopes to the mills and factories in the valleys below. Comparatively few streams, however, carry sufficient water during the summer months, and it has been necessary to build temporary dams on a large number of streams, where the logs are stored until released by opening the gates in the dam. The "splash" thus caused usually suffices to carry the logs to their destination.

The highest recorded flood in the Columbia River occurred in June, 1894. The highest floods on the tributaries of this river are invariably caused by "chinook"—a warm wind, usually accompanied by rain, occurring in the spring and fall. The fall "chinook" usually brings the highest waters, since it may occur immediately after a heavy snow has covered the mountain ranges. The Columbia itself is not greatly affected at such times.

Investigations of the flow have been made on the following tributaries of the Columbia:

Clark Fork.
Chelan River.
Spokane River.
Methow River.
Wenatchee River.
Yakima River.
Snake River.
Walla Walla River.
Umatilla River.
John Day River.
Deschutes River.
Willamette River.

Discharge records have been obtained on the Columbia River proper at one point only—The Dalles and Cascade Locks (1879 to 1908)—but gage heights have been obtained at the following places by the United States Weather Bureau and the United States Army engineers:

Fort Stevens, Oreg.
Vancouver, Wash.
Cascade Locks, Oreg.
The Dalles, Oreg.
Celilo, Oreg.
Umatilla, Oreg.
Pasco, Wash.
Wenatchee, Wash.

COLUMBIA RIVER.

COLUMBIA RIVER NEAR PASCO, WASH.

This station was established October 15, 1904. It is located at the Northern Pacific Railway bridge near Pasco, 4 miles above the mouth of Snake River and 7 miles below the mouth of Yakima River. Only one current-meter measurement has been made at this station. The gage heights, however, are complete, and it is hoped that future measurements will develop a rating curve to which these can be applied. Since September 1, 1908, the records have been furnished by the United States Weather Bureau. The datum of the gage is 307.75 feet above sea level.

Daily gage height, in feet, of Columbia River near Pasco, Wash., for 1907 and 1908.

[W. B. Sloan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	11.5	9.6	12.5	12.1	16.7	26.2	25.4	20.2	15.8	13.4	10.7	9.7
2	11.3	9.8	12.3	12.3	16.7	26.8	25.7	20.0	15.8	13.3	10.7	9.7
3	11.0	9.5	12.1	12.5	16.7	27.0	25.7	19.9	15.9	13.2	10.6	9.7
4	10.9	9.2	11.9	12.8	16.8	27.2	25.8	19.8	15.8	13.0	10.6	9.7
5	10.8	9.0	11.7	13.0	16.9	26.9	25.9	19.7	15.7	12.9	10.5	9.6
6	10.9	8.8	11.6	13.0	17.1	26.7	25.9	19.6	15.6	12.8	10.4	9.6
7	10.9	11.3	11.5	13.1	17.5	26.8	25.6	19.5	15.4	12.7	10.4	9.6
8	10.4	12.3	11.4	13.2	17.8	26.8	25.4	19.4	15.3	12.6	10.3	9.5
9	10.4	12.5	11.4	13.3	18.2	26.8	25.2	19.4	15.3	12.5	10.3	9.5
10	10.2	12.5	11.4	13.6	18.8	26.6	25.0	19.0	15.2	12.4	10.3	9.5
11	10.0	12.2	11.6	14.2	19.4	26.4	24.8	18.8	15.2	12.3	10.2	9.5
12	10.0	11.9	11.6	14.8	20.0	26.3	24.6	18.5	15.1	12.2	10.2	9.5
13	9.9	11.8	11.6	15.0	20.2	26.3	24.3	18.2	15.1	12.2	10.2	9.5
14	9.2	11.5	11.5	15.4	20.3	26.1	24.1	17.9	15.0	12.2	10.1	9.5
15	8.9	11.1	11.4	16.0	20.3	26.0	24.0	17.7	15.0	12.1	10.1	9.4

Daily gage height, in feet, of Columbia River near Pasco, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	9.4	10.8	11.2	16.5	20.5	25.7	23.6	17.5	14.8	12.1	10.1	9.4
17	9.2	10.8	11.0	17.0	21.4	25.5	23.4	17.2	14.7	12.0	10.0	9.3
18	9.1	10.8	11.0	17.2	22.5	25.3	23.2	16.9	14.6	11.9	10.0	9.2
19	9.1	10.9	11.0	17.1	23.4	25.1	23.0	16.7	14.5	11.8	9.9	9.2
20	9.3	11.0	12.1	16.9	24.0	25.0	22.7	16.5	14.5	11.8	9.8	9.1
21	9.3	11.3	13.5	16.5	24.5	24.9	22.4	16.4	14.4	11.7	9.8	9.0
22	9.2	11.7	15.4	16.4	24.8	25.1	22.1	16.3	14.2	11.7	9.7	8.9
23	9.2	11.9	15.3	16.5	25.0	25.2	22.0	16.2	14.0	11.6	9.6	8.9
24	9.3	12.1	14.6	16.8	25.2	25.1	21.8	16.1	13.9	11.6	9.5	8.9
25	9.3	12.2	14.3	17.0	25.2	25.0	21.6	16.0	13.8	11.5	9.5	9.0
26	9.2	12.3	13.7	17.1	25.2	24.9	21.4	15.8	13.7	11.4	9.6	9.1
27	8.8	12.7	13.3	17.1	25.2	24.8	21.2	15.7	13.6	11.3	9.6	9.2
28	8.2	12.7	12.9	17.0	25.4	25.0	21.0	15.7	13.5	11.1	9.7	9.2
29	8.2	.....	12.7	16.9	25.5	25.3	20.8	15.7	13.3	11.0	9.7	9.1
30	8.6	.....	12.4	16.9	25.6	25.4	20.6	15.8	13.1	10.9	9.7	9.1
31	8.9	.....	12.1	.....	25.9	.....	20.4	15.8	.....	10.8	.....	9.0
1908.												
1	8.9	7.8	8.0	10.7	18.1	23.0	25.6	20.8	14.3	11.2	9.3	10.4
2	8.8	7.7	8.1	10.6	18.3	23.0	25.5	20.3	14.0	11.1	9.3	10.3
3	8.8	7.7	8.1	10.5	18.7	23.1	25.5	19.9	13.8	11.0	9.3	10.2
4	8.8	7.6	8.1	10.5	19.1	23.2	25.3	19.5	13.6	10.8	9.3	10.1
5	8.7	7.6	8.1	10.4	19.3	23.5	25.2	19.1	13.4	10.7	9.3	10.0
6	8.7	7.5	8.1	10.5	19.3	24.0	25.0	18.7	13.2	10.6	9.3	9.9
7	8.6	7.5	8.0	10.5	19.4	24.4	24.6	18.5	13.0	10.5	9.3	9.8
8	8.5	7.6	8.0	10.5	19.8	24.8	24.4	18.1	12.8	10.5	9.4	9.7
9	8.5	7.7	7.9	10.4	20.5	25.3	24.2	17.7	12.6	10.4	9.4	9.5
10	8.5	7.8	7.9	10.4	20.9	26.1	24.0	17.4	12.5	10.2	9.5	9.5
11	8.4	7.8	7.8	10.3	21.3	26.8	23.8	17.1	12.4	10.1	9.6	9.5
12	8.4	7.7	7.7	10.5	21.0	27.3	23.6	16.9	12.4	10.0	9.6	9.5
13	8.3	7.7	7.8	11.0	21.0	28.0	23.4	16.7	12.3	10.0	9.7	9.5
14	8.3	7.7	8.0	11.5	21.1	28.4	23.4	16.6	12.3	10.0	9.7	9.4
15	8.2	7.7	8.5	12.4	21.2	28.5	23.6	16.4	12.2	10.0	9.7	9.3
16	8.2	7.7	9.5	12.9	21.5	28.7	23.5	16.2	12.2	10.0	9.8	9.2
17	8.2	7.7	13.8	13.6	21.9	28.9	23.7	16.0	12.1	10.0	9.8	9.1
18	8.2	7.8	13.5	14.2	22.0	28.9	23.7	15.8	12.1	10.0	9.9	9.0
19	8.2	7.8	12.9	14.6	22.0	28.7	23.6	15.6	12.0	9.9	10.0	8.9
20	8.2	7.9	12.5	15.0	22.0	28.4	23.5	15.4	12.0	9.9	10.1	8.8
21	8.2	7.9	12.0	16.0	22.2	28.0	23.4	15.2	11.9	9.9	10.2	8.8
22	8.2	7.9	12.0	16.8	22.4	27.6	23.1	15.1	11.9	9.8	10.3	8.7
23	8.1	7.8	11.5	17.8	22.4	27.4	23.0	15.0	11.8	9.8	10.3	8.7
24	8.0	7.8	11.3	18.5	22.4	27.0	22.8	15.0	11.7	9.7	10.4	8.6
25	8.0	7.8	11.3	18.5	22.3	26.7	22.6	14.9	11.7	9.6	10.4	8.6
26	8.0	7.7	11.4	18.6	22.5	26.5	22.4	14.9	11.6	9.5	10.5	8.6
27	7.9	7.8	11.5	18.4	22.8	26.5	22.2	14.9	11.6	9.4	10.5	8.6
28	7.9	7.9	11.3	18.3	23.0	26.4	22.0	14.8	11.5	9.3	10.5	8.5
29	7.9	8.0	11.2	18.1	23.0	26.2	21.7	14.8	11.4	9.3	10.4	8.5
30	7.8	.....	11.0	18.0	23.0	25.9	21.5	14.7	11.3	9.3	10.4	8.5
31	7.8	.....	11.0	.....	23.0	.....	21.2	14.5	.....	9.3	.....	8.4

COLUMBIA RIVER AT THE DALLES, OREG.

This station is located at The Dalles, below the mouth of Deschutes River and above Hood and Klickitat rivers. Records of gage heights have been kept at this point by the Weather Bureau since 1892. A number of measurements were made in 1903 by the United States Engineer Corps. In 1907 and 1908 measurements were made by the Geological Survey, and these in connection with the earlier measurements fully develop the discharge curve. (See Pl. IV.)

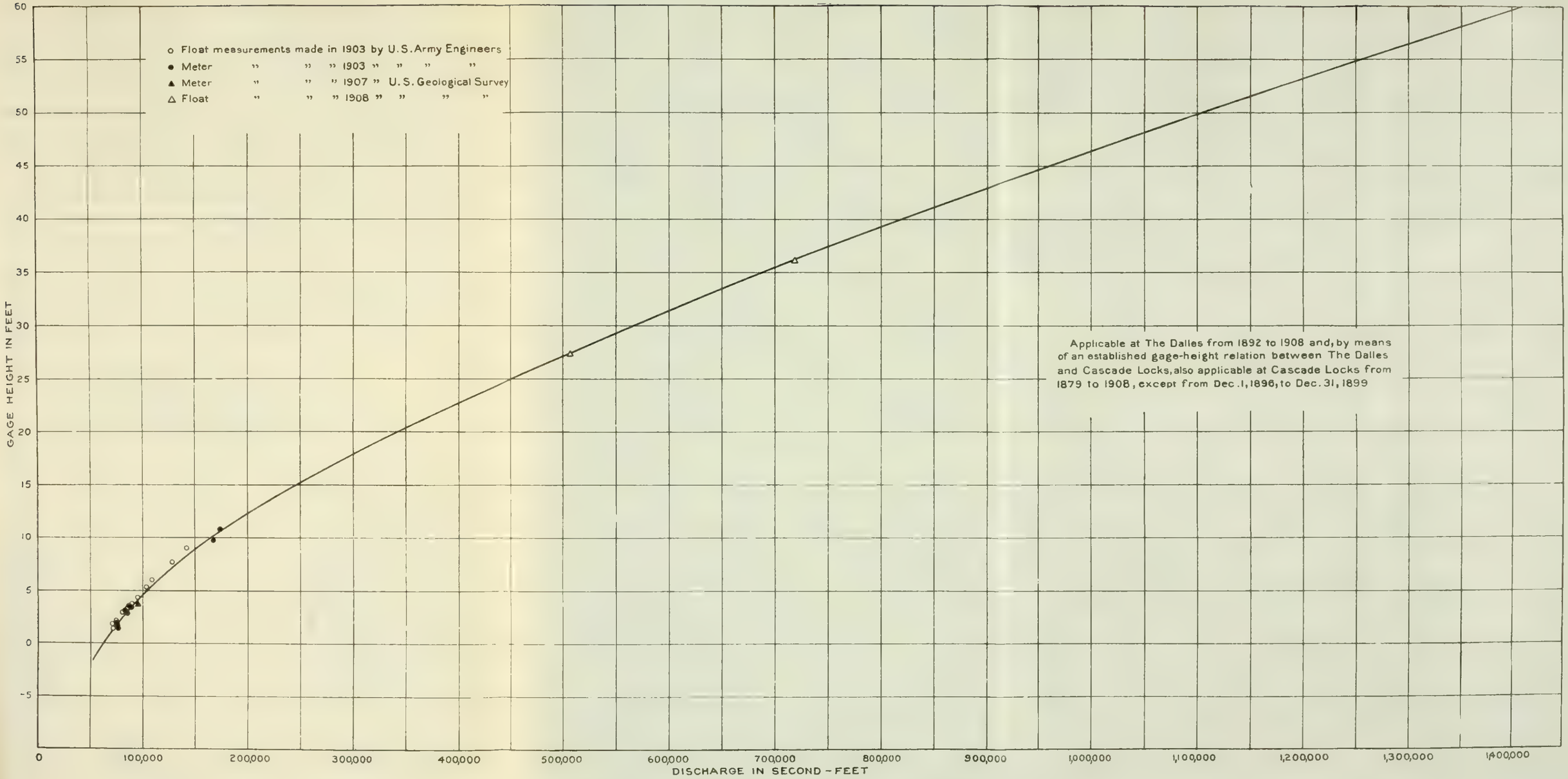
A comparison has also been made between the gage readings at The Dalles and those taken at Cascade Locks, 20 miles down the

river. At the lower point the gage records are nearly complete for thirty years. The elevation of gage datum at The Dalles is 45.6 feet and at Cascade Locks 42.5 feet above sea level. The locks were formally opened in 1896, and at that time the gage was moved, a datum 6 feet lower than the former gage being used until December 31, 1899. The conditions at the locks are such that a permanent rating is perfectly feasible. At this point the river breaks over a ledge of rock, falling about 20 feet in one-fourth mile. It is practically certain that the channel conditions have remained permanent since the readings began in 1879, and the very stable relation which is found between the gage records at this point and those at The Dalles indicate that the channel conditions at The Dalles have also been permanent. The drainage area between the two points is about 2,600 square miles, or about 1 per cent of the total drainage area of the river. Hood River, from the Oregon side, and Klickitat and White Salmon rivers from the Washington side, are the principal intervening tributaries.

The extreme low-water periods of the intervening streams do not coincide with those of the Columbia, occurring in September instead of in February. In September the discharge from the rivers intervening is about 1 or 2 per cent of the flow in the Columbia. In February it is probably from 4 to 10 per cent.

In view of the value which long-time records of flow have in a general study of run-off conditions throughout the country, it is believed that the discharges determined from the measurements made at The Dalles and gage heights at Cascade Locks, and a comparison of the gages at The Dalles and the Cascade Locks, will be welcomed by engineers of the country. The records are liable to some error at extremely low stages, as no measurements have been made below gage height 1.4 feet on The Dalles gage, and the relation of the gage readings is uncertain below gage height −0.5 foot, so the low-water discharges prior to 1892 are probably subject to greater error than those since that date, since they are made up from the gage readings at Cascade Locks.

In the adjustment of a discharge curve among the measurements greater weight was given those made by current meter than those by floats. The floats used by the Engineer Corps were long rods weighted to float in an upright position, reaching from the surface to as near the bed of the river as practicable. The float and meter measurements by the Engineer Corps were made at Cayuse Rock over a 1,000-foot range, 7 miles below The Dalles. The float measurements of June 20 and July 9, 1908, were made at The Dalles gaging station over a 1,000-foot range. The floats used were weighted rods, 5 feet in length. The points where they crossed the gage lines were determined by a transit. A coefficient of 1.05 was used to reduce surface to mean velocities in the vertical. This coefficient is



DISCHARGE CURVE FOR COLUMBIA RIVER AT THE DALLES, OREG.

the mean coefficient from ten vertical velocity curves taken October 31, 1907. For this measurement a large Price current meter held on a piano wire was used. A small cable was thrown across the channel, fastened at the water's edge on each bank, and allowed to sag below the surface just sufficient to permit the passage of steamers. The cable was tagged at 10-foot intervals and used to hold a small boat from which the meter was operated. In this manner it was possible to take velocities at all points in the vertical, although depths of nearly 90 feet were encountered. A reeling device was used to measure depths whereby the position of the meter below the surface at all times was indicated by a dial. The shape of the vertical velocity curves for such depths is found to be somewhat different in shallow water, the curve being nearly vertical except near the top and bottom, where it curves gently toward the lower velocities. This readily accounts for the high coefficient found for surface velocities.

The gage height records at both The Dalles and Cascade Locks have been published up to December 31, 1906, in the Weather Bureau reports of "Daily river stages of the principal rivers of the United States" as follows:

The Dalles, 1892, Part IV, p. 433.
The Dalles, 1893–1895, Part V, pp. 29–31.
Cascade Locks, 1879–1895, Part V, pp. 539–555.
The Dalles and Cascade Locks, 1896–1899, Part VI, 108–111.
The Dalles and Cascade Locks, 1900–1904, Part VII, pp. 193–197.
The Dalles and Cascade Locks, 1905–6, Part VIII, p. 71.

Discharge measurements of Columbia River at The Dalles, Oreg., in 1903, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 20 *a*	United States Engineer Corps	2,100	59,400	2.90	80,700
January 22 *b*	do	2,130	60,400	3.50	86,900
January 27 *b*	do	2,280	76,100	9.70	168,000
January 28 *b*	do	2,290	76,700	10.70	174,000
January 30 *a*	do	2,260	71,500	9.00	142,000
January 31 *a*	do	2,220	68,600	7.70	128,000
February 2 *a*	do	2,160	64,900	6.00	109,000
February 3 *a*	do	2,140	63,500	5.30	104,000
Februray 5 *a*	do	2,100	62,100	4.30	95,300
February 6 *a*	do	2,130	60,800	3.70	89,700
February 11 *b*	do	2,120	61,000	3.50	88,700
February 12 *a*	do	2,120	60,300	3.30	85,100
February 13 *b*	do	2,110	60,400	3.10	83,500
February 14 *b*	do	2,090	59,900	2.80	85,500
February 16 *a*	do	2,040	57,900	2.10	74,500
February 17 *b*	do	2,030	57,900	1.80	76,200
February 18 *a*	do	2,020	56,700	1.80	71,100
February 19 *b*	do	2,020	57,600	1.60	76,400
February 20 *a*	do	2,020	56,100	1.40	72,100
February 20 *b*	do	2,020	58,000	1.40	77,300
1907.					
October 31 *b*	J. C. Stevens	1,040	62,800	3.72	95,400
1908.					
June 20 *a*	H. D. McGlashan	1,200	101,000	36.20	719,000
July 9 *a*	McGlashan and Allen	1,190	89,200	27.40	507,000

a Float measurement. *b* Meter measurement.

Daily gage height, in feet, of Columbia River at The Dalles, Oreg., for 1907 and 1908.

[U. S. Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	8.0	6.0	11.7	9.4	16.2	31.8	30.7	19.4	10.8	7.4	3.6	3.0
2	7.8	5.9	10.6	9.1	15.7	32.4	31.0	19.2	10.9	7.4	3.8	2.9
3	7.4	5.6	10.1	9.2	15.7	33.2	31.0	18.8	10.9	7.3	3.8	2.8
4	7.6	5.5	9.4	10.0	15.9	34.0	31.0	18.4	10.8	6.9	3.8	2.7
5	7.2	5.5	8.7	10.4	16.1	34.1	31.0	17.9	10.8	6.7	3.6	2.8
6	6.8	7.7	8.2	11.0	16.2	33.7	31.5	17.7	10.8	6.7	3.6	2.7
7	6.7	10.4	7.9	11.6	16.6	33.5	31.0	17.5	10.8	6.6	3.4	2.7
8	6.2	11.4	7.6	12.1	17.1	33.7	30.6	17.2	10.7	6.6	3.1	2.6
9	5.8	13.2	7.3	12.5	17.5	33.9	30.1	17.0	10.6	6.5	3.0	2.6
10	5.2	12.9	7.6	13.3	18.3	33.8	29.6	16.5	10.6	6.4	2.9	2.5
11	5.0	12.2	7.8	13.3	19.0	33.1	29.1	16.0	10.5	6.3	2.8	2.7
12	4.6	11.3	8.2	14.1	20.0	32.5	28.9	15.5	10.4	6.2	2.8	2.8
13	3.9	10.2	8.6	15.0	21.5	32.0	28.4	15.4	9.9	6.1	2.9	3.3
14	2.6	9.4	8.3	15.2	21.8	32.2	27.7	15.2	9.9	6.1	3.0	3.2
15	2.2	8.8	8.1	16.1	21.8	32.4	27.4	14.7	9.8	6.0	3.0	2.9
16	1.9	8.1	7.7	17.4	21.6	32.0	27.0	14.1	9.7	5.8	3.0	2.7
17	2.6	7.6	7.3	17.9	22.0	31.0	26.4	13.6	9.5	5.7	2.9	2.4
18	3.1	7.6	7.1	18.3	23.5	30.6	25.8	13.1	9.3	5.6	2.8	2.5
19	3.6	8.1	6.9	18.4	25.6	30.1	25.1	12.6	9.0	5.4	2.7	2.2
20	3.7	8.5	7.7	18.0	27.4	29.5	24.5	12.1	8.8	5.3	2.7	2.0
21	4.8	8.7	9.6	17.4	28.6	29.2	23.9	12.0	8.7	5.2	2.6	1.9
22	5.1	8.9	12.6	16.9	29.5	29.1	23.4	12.0	8.7	5.1	2.6	2.1
23	5.4	9.5	15.9	16.4	30.1	29.6	22.9	11.9	8.7	4.9	2.6	3.4
24	4.9	9.8	15.7	16.4	30.3	29.9	22.4	11.6	8.7	4.8	3.0	3.8
25	4.7	10.4	14.7	16.6	30.5	29.7	22.0	11.6	8.6	4.7	3.3	3.6
26	4.2	10.7	13.7	17.1	30.5	29.4	21.5	11.1	8.4	4.6	3.4	6.0
27	3.7	10.9	12.6	17.2	30.5	29.1	21.1	10.9	7.9	4.5	3.3	5.0
28	3.2	11.3	11.8	17.0	30.6	29.0	20.6	10.8	7.7	4.4	3.0	4.5
29	2.6	.....	11.1	16.6	30.6	29.3	20.1	11.1	7.6	4.3	2.9	4.2
30	1.9	.....	10.5	16.6	30.6	30.1	19.7	11.0	7.4	4.1	2.8	3.5
31	1.9	.....	9.9	.....	31.0	.....	19.4	10.8	.....	3.9	.....	3.2
1908.												
1	3.0	.6	1.3	6.6	17.2	25.0	30.5	19.7	9.0	4.5	2.6	3.4
2	2.7	−.1	1.5	6.4	17.1	24.8	30.1	18.9	8.8	4.5	2.6	3.0
3	2.5	−.2	1.5	6.4	17.5	24.9	29.9	18.0	8.5	4.4	2.6	2.9
4	2.4	−.4	1.5	6.0	18.3	25.0	29.8	17.8	8.2	4.1	2.8	2.9
5	2.3	−.5	1.5	5.8	19.1	25.2	29.6	16.4	7.9	4.0	2.9	2.9
6	2.3	−.1	1.5	5.7	19.2	26.7	29.1	15.9	7.6	3.7	2.8	2.8
7	2.1	.2	1.5	5.8	19.2	27.8	28.7	15.4	7.3	3.3	2.8	2.8
8	2.0	.1	1.3	5.6	19.3	28.3	28.0	14.8	6.7	3.2	2.7	2.7
9	2.1	.1	1.0	5.5	20.2	29.0	27.5	14.3	6.5	3.2	2.5	2.7
10	1.9	.5	.9	5.4	21.5	30.0	27.0	14.0	6.2	3.1	2.5	2.6
11	1.8	.5	1.0	5.2	22.0	32.0	26.5	13.5	6.0	3.2	2.5	2.5
12	1.7	.8	1.0	5.4	22.1	33.1	26.0	13.1	6.1	3.1	2.5	2.4
13	1.5	.7	1.0	5.9	21.9	34.1	25.7	12.5	6.0	3.0	2.5	2.4
14	1.5	.6	1.9	6.7	21.5	35.3	25.3	12.2	5.9	3.0	2.5	2.4
15	1.4	.5	3.0	8.1	21.6	36.0	25.0	11.9	6.0	2.9	2.5	2.3
16	1.2	.4	3.3	9.6	21.8	36.3	25.0	11.6	5.8	2.8	2.6	2.1
17	1.2	.6	9.1	10.5	22.4	36.8	24.8	11.2	5.7	2.9	2.8	2.1
18	1.1	.5	14.1	11.8	22.5	37.1	24.6	11.0	5.5	3.7	3.0	1.8
19	1.2	.6	13.4	13.0	22.7	36.8	24.9	10.8	5.3	3.8	2.9	1.5
20	1.5	.7	12.0	13.1	22.8	36.2	24.7	10.4	5.4	4.1	3.0	1.2
21	1.5	.6	10.8	13.9	22.8	35.6	24.4	10.2	5.5	3.9	3.3	.9
22	1.3	.7	9.9	15.3	23.2	34.8	24.2	10.0	5.6	3.3	3.7	.6
23	1.2	.7	9.0	16.5	23.3	33.9	23.8	9.9	5.7	3.0	3.9	.5
24	1.3	.7	8.0	17.9	23.5	33.5	23.3	9.8	5.5	3.0	4.0	.6
25	1.4	.6	7.5	19.3	23.5	32.7	23.0	9.5	5.2	3.0	4.0	.6
26	1.1	.6	7.5	19.0	23.5	32.1	22.6	9.3	4.9	2.7	4.0	1.0
27	.9	.6	7.8	19.0	24.0	31.6	22.0	9.3	4.9	2.6	3.9	1.3
28	.7	.6	7.8	18.4	24.4	31.7	21.6	9.3	4.8	2.7	3.7	1.3
29	.6	.9	7.4	17.7	24.6	31.5	21.0	9.3	4.7	2.7	3.7	1.5
30	.6	.....	7.1	17.3	24.8	30.9	20.4	9.4	4.5	2.6	3.7	1.1
31	.4	.....	7.0	.....	24.9	.....	20.1	9.1	.....	2.7	.....	.9

Relation of gage heights on Columbia River at The Dalles and Cascade Locks, Oreg., from 1892 to 1908.

Cascade Locks gage height.	Gage height at The Dalles.	Cascade Locks gage height.	Gage height at The Dalles.	Cascade Locks gage height.	Gage height at The Dalles.	Cascade Locks gage height.	Gage height at The Dalles.
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
−4.00	−3.90	10.00	13.20	24.00	30.80	38.00	46.40
−3.00	−2.95	11.00	14.50	25.00	32.00	39.00	47.50
−2.00	−1.95	12.00	15.75	26.00	33.10	40.00	48.60
−1.00	− .90	13.00	17.05	27.00	34.20	41.00	49.70
0.00	.25	14.00	18.30	28.00	35.30	42.00	50.80
1.00	1.55	15.00	19.60	29.00	36.40	43.00	51.90
2.00	2.80	16.00	20.85	30.00	37.50	44.00	53.00
3.00	4.10	17.00	22.15	31.00	38.65	45.00	54.10
4.00	5.40	18.00	23.45	32.00	39.75	46.00	55.20
5.00	6.70	19.00	24.75	33.00	40.85	47.00	56.30
6.00	8.00	20.00	26.00	34.00	42.00	48.00	57.40
7.00	9.30	21.00	27.20	35.00	43.10	49.00	58.50
8.00	10.60	22.00	28.40	36.00	44.20	50.00	59.60
9.00	11.90	23.00	29.60	37.00	45.30		

NOTE.—The above table is based on a curve determined by the plotting of the monthly mean gage heights at the two stations for 1892 to 1906, and is well defined above gage height 0.5 foot.

Rating table for Columbia River at The Dalles, Oreg., for 1892 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−1.70	51,800	2.40	80,600	7.00	126,000	20.00	342,000
−1.60	52,400	2.50	81,500	7.20	128,400	21.00	363,000
−1.50	53,000	2.60	82,400	7.40	130,800	22.00	384,000
−1.40	53,600	2.70	83,300	7.60	133,200	23.00	406,000
−1.30	54,200	2.80	84,200	7.80	135,600	24.00	428,000
−1.20	54,800	2.90	85,100	8.00	138,000	25.00	450,000
−1.10	55.400	3.00	86,000	8.20	140,600	26.00	473,000
−1.00	56,000	3.10	86,900	8.40	143,200	27.00	496,000
− .90	56,600	3.20	87,800	8.60	145,800	28.00	519,000
− .80	57,200	3.30	88,700	8.80	148,400	29.00	542,000
− .70	57,800	3.40	89,600	9.00	151,000	30.00	566,000
− .60	58.400	3.50	90,500	9.20	153,800	31.00	590,000
− .50	59,000	3.60	91,400	9.40	156,600	32.00	614.000
− .40	59,600	3.70	92,300	9.60	159,400	33.00	638,000
− .30	60,200	3.80	93,200	9.80	162,200	34.00	663,000
− .20	60,800	3.90	94,100	10.00	165,000	35.00	688,000
− .10	61,400	4.00	95,000	10.20	168,000	36.00	714,000
.00	62,000	4.10	96,000	10.40	171,000	37.00	740,000
.10	62,700	4.20	97,000	10.60	174,000	38.00	766,000
.20	63,400	4.30	98,000	10.80	177,000	39.00	792,000
.30	64.100	4.40	99,000	11.00	180,000	40.00	819,000
.40	64,800	4.50	100,000	11.20	183,000	41.00	847,000
.50	65,500	4.60	101,000	11.40	186,000	42.00	875,000
.60	66,200	4.70	102,000	11.60	189,000	43.00	903,000
.70	66,900	4.80	103,000	11.80	192,000	44.00	931,000
.80	67,600	4.90	104,000	12.00	195,000	45.00	960,000
.90	68,300	5.00	105,000	12.20	198,200	46.00	989,000
1.00	69,000	5.10	106,000	12.40	201,400	47.00	1,018,000
1.10	69,800	5.20	107,000	12.60	204,600	48.00	1,047,000
1.20	70,600	5.30	108,000	12.80	207,800	49.00	1,076,000
1.30	71,400	5.40	109,000	13.00	211,000	50.00	1,106,000
1.40	72,200	5.50	110,000	13.20	214,400	51.00	1,136,000
1.50	73,000	5.60	111,000	13.40	217,800	52.00	1,166,000
1.60	73,800	5.70	112,000	13.60	221,200	53.00	1,196,000
1.70	74,600	5.80	113,000	13.80	224,600	54.00	1,226,000
1.80	75,400	5.90	114,000	14.00	228,000	55.00	1,256,000
1.90	76,200	6.00	115,000	15.00	246,000	56.00	1,286,000
2.00	77,000	6.20	117,200	16.00	264,000	57.00	1,317,000
2.10	77,900	6.40	119,400	17.00	283,000	58.00	1,348,000
2.20	78,800	6.60	121,600	18.00	302,000	59.00	1,380,000
2.30	79,700	6.80	123,800	19.00	322,000	60.00	1,412,000

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 10 current-meter measurements at low and medium stages, and two float measurements at high stages, and is well defined between gage heights 1.0 foot and 37.0 feet.

Rating table for Columbia River at Cascade Locks, Oreg., for 1879 to 1908, except December 1, 1896, to December 31, 1899.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−2.30	48,500	1.30	76,500	5.80	134,800	16.00	359,800
−2.20	49,100	1.40	77,600	6.00	138,000	17.00	387,300
−2.10	49,700	1.50	78,700	6.20	141,200	18.00	415,300
−2.00	50,300	1.60	79,800	6.40	144,600	19.00	443,300
−1.90	50,900	1.70	80,900	6.60	148,000	20.00	471,300
−1.80	51,500	1.80	82,000	6.80	151,600	21.00	499,300
−1.70	52,100	1.90	83,100	7.00	155,200	22.00	527,300
−1.60	52,700	2.00	84,200	7.20	158,800	23.00	555,300
−1.50	53,300	2.10	85,300	7.40	162,600	24.00	583,300
−1.40	53,900	2.20	86,400	7.60	166,400	25.00	611,300
−1.30	54,500	2.30	87,600	7.80	170,200	26.00	639,300
−1.20	55,200	2.40	88,800	8.00	174,000	27.00	667,300
−1.10	55,900	2.50	90,000	8.20	177,800	28.00	695,800
−1.00	56,600	2.60	91,200	8.40	181,600	29.00	724,800
− .90	57,300	2.70	92,400	8.60	185,500	30.00	753,800
− .80	58,000	2.80	93,600	8.80	189,500	31.00	783,000
− .70	58,700	2.90	94,800	9.00	193,500	32.00	813,000
− .60	59,400	3.00	96,000	9.20	197,600	33.00	843,000
− .50	60,100	3.10	97,300	9.40	201,800	34.00	874,000
− .40	60,800	3.20	98,600	9.60	206,000	35.00	905,000
− .30	61,500	3.30	99,900	9.80	210,200	36.00	936,000
− .20	62,200	3.40	101,200	10.00	214,400	37.00	968,000
− .10	63,000	3.50	102,500	10.20	218,800	38.00	1,000,000
.00	63,800	3.60	103,800	10.40	223,200	39.00	1,032,000
.10	64,700	3.70	105,100	10.60	227,600	40.00	1,064,000
.20	65,600	3.80	106,400	10.80	232,000	41.00	1,097,000
.30	66,500	3.90	107,700	11.00	236,400	42.00	1,130,000
.40	67,400	4.00	109,000	11.20	241,000	43.00	1,163,000
.50	68,400	4.20	111,600	11.40	245,600	44.00	1,196,000
.60	69,400	4.40	114,300	11.60	250,200	45.00	1,229,000
.70	70,400	4.60	117,100	11.80	254,800	46.00	1,262,000
.80	71,400	4.80	119,900	12.00	259,500	47.00	1,295,000
.90	72,400	5.00	122,700	13.00	283,500	48.00	1,329,000
1.00	73,400	5.20	125,700	14.00	308,000	49.00	1,364,000
1.10	74,400	5.40	128,700	15.00	333,800	50.00	1,400,000
1.20	75,400	5.60	131,700				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made at The Dalles, and the relation between the gages, and is well defined between gage heights 1.0 foot and 30.0 feet.,

Gage heights for December 1, 1896, to December 31, 1899, have been corrected −6.00 feet to reduce to the same datum as other readings before applying this table.

Monthly discharge of Columbia River at The Dalles, Oreg.

[Drainage area, 237,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1879.							
January	77,600	70,400	73,300	0.309	0.36	4,510,000	B.
February	260,000	66,500	99,500	.420	.44	5,530,000	B.
March	398,000	159,000	214,000	.903	1.04	13,200,000	B.
April	564,000	393,000	452,000	1.91	2.13	26,900,000	B.
May	681,000	410,000	493,000	2.08	2.40	30,300,000	B.
June	789,000	687,000	751,000	3.17	3.54	44,700,000	B.
July	748,000	480,000	622,000	2.62	3.02	38,200,000	B.
August	477,000	248,000	339,000	1.43	1.65	20,800,000	B.
September	241,000	135,000	178,000	.751	.84	10,600,000	B.
October	141,000	109,000	125,000	.527	.61	7,690,000	B.
November	105,000	85,300	97,100	.410	.46	5,780,000	B.
December	116,000	65,600	93,200	.393	.45	5,730,000	B.
The year	789,000	65,600	295,000	1.24	16.94	214,000,000	

NOTE.—Discharges for 1879 to 1891, inclusive, are based on gage heights at Cascade Locks.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1880.							
January	132,000	76,500	114,000	0.481	0.55	7,010,000	B.
February	106,000	75,400	87,500	.369	.40	5,030,000	B.
March	112,000	74,400	83,400	.352	.41	5,130,000	B.
April	274,000	99,900	173,000	.730	.81	10,300,000	B.
May	678,000	303,000	516,000	2.18	2.51	31,700,000	B.
June	1,120,000	699,000	858,000	3.62	4.04	51,100,000	B.
July	1,130,000	786,000	973,000	4.11	4.74	59,800,000	B.
August	757,000	310,000	481,000	2.03	2.34	29,600,000	B.
September	300,000	166,000	226,000	.954	1.06	13,400,000	B.
October	164,000	121,000	137,000	.578	.67	8,420,000	B.
November	136,000	91,200	115,000	.485	.54	6,840,000	B.
December	118,000	78,700	96,000	.405	.47	5,900,000	B.
The year	1,130,000	74,400	322,000	1.36	18.54	234,000,000	
1881.							
January	214,000	91,200	125,000	.527	.61	7,690,000	B.
February	494,000	93,600	260,000	1.10	1.14	14,400,000	B.
March	424,000	178,000	259,000	1.09	1.26	15,900,000	B.
April	642,000	323,000	497,000	2.10	2.34	29,600,000	B.
May	572,000	519,000	544,000	2.30	2.65	33,400,000	B.
June	742,000	552,000	686,000	2.89	3.22	40,800,000	B.
July	684,000	393,000	537,000	2.27	2.62	33,000,000	B.
August	390,000	212,000	296,000	1.25	1.44	18,200,000	B.
September	208,000	141,000	162,000	.684	.76	9,640,000	B.
October	148,000	112,000	124,000	.523	.60	7,620,000	B.
November	153,000	102,000	126,000	.532	.59	7,500,000	B.
December	104,000	87,600	97,000	.409	.47	5,960,000	B.
The year	742,000	87,600	309,000	1.31	17.70	224,000,000	
1882.							
January	106,000	67,400	88,100	.372	.43	5,420,000	B.
February	104,000	67,400	74,900	.316	.33	4,160,000	B.
March	219,000	84,200	112,000	.473	.55	6,890,000	B.
April	321,000	225,000	275,000	1.16	1.29	16,400,000	B.
May	667,000	250,000	419,000	1.77	2.04	25,800,000	B.
June	1,090,000	664,000	947,000	4.00	4.46	56,400,000	B.
July	789,000	404,000	592,000	2.50	2.88	36,400,000	B.
August	393,000	236,000	322,000	1.36	1.57	19,800,000	B.
September	232,000	133,000	173,000	.730	.81	10,300,000	B.
October	135,000	114,000	124,000	.523	.60	7,620,000	B.
November	121,000	88,800	105,000	.443	.49	6,250,000	B.
December	232,000	87,600	139,000	.586	.68	8,550,000	B.
The year	1,090,000	67,400	281,000	1.19	16.13	204,000,000	
1883.							
January	170,000	65,600	98,300	.415	.48	6,040,000	B.
February	170,000	71,400	98,600	.416	.43	5,480,000	B.
March	371,000	136,000	215,000	.907	1.05	13,200,000	B.
April	349,000	194,000	233,000	.983	1.10	13,900,000	B.
May	648,000	230,000	499,000	2.11	2.43	30,700,000	B.
June	704,000	611,000	657,000	2.77	3.09	39,100,000	B.
July	667,000	296,000	493,000	2.08	2.40	30,300,000	B.
August	286,000	182,000	239,000	1.01	1.16	14,700,000	B.
September	176,000	116,000	143,000	.603	.67	8,510,000	B.
October	113,000	88,800	102,000	.430	.50	6,270,000	B.
November	96,000	77,600	83,400	.352	.39	4,960,000	B.
December	94,800	72,400	82,500	.348	.40	5,070,000	B.
The year	704,000	65,600	245,000	1.04	14.10	178,000,000	
1884.							
January	106,000	65,600	81,200	.343	.40	4,990,000	B.
February	190,000	50,300	80,400	.339	.37	4,620,000	B.
March	136,000	98,600	118,000	.498	.57	7,260,000	B.
April	355,000	132,000	242,000	1.02	1.14	14,400,000	B.
May	716,000	303,000	498,000	2.10	2.42	30,600,000	B.
June	795,000	664,000	736,000	3.11	3.47	43,800,000	B.
July	648,000	321,000	448,000	1.89	2.18	27,500,000	B.
August	323,000	194,000	268,000	1.13	1.30	16,500,000	B.
September	196,000	120,000	164,000	.692	.77	9,760,000	B.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1884.							
October	146,000	109,000	130,000	0.549	0.63	7,990,000	B.
November	155,000	113,000	131,000	.553	.62	7,800,000	B.
December [a]	108,000	60,800	82,300	.347	.40	5,060,000	C.
The year	795,000	50,300	248,000	1.05	14.27	180,000,000	
1885.							
January	120,000	73,400	91,000	.384	.44	5,600,000	B.
February	190,000	93,600	162,000	.684	.71	9,000,000	B.
March	225,000	145,000	189,000	.797	.92	11,600,000	B.
April	310,000	219,000	272,000	1.15	1.28	16,200,000	B.
May	485,000	246,000	412,000	1.74	2.01	25,300,000	B.
June	541,000	432,000	497,000	2.10	2.34	29,600,000	B.
July	499,000	239,000	362,000	1.53	1.76	22,300,000	B.
August	241,000	182,000	205,000	.865	1.00	12,600,000	B.
September	178,000	135,000	151,000	.637	.71	8,980,000	B.
October	159,000	93,600	120,000	.506	.58	7,380,000	B.
November	112,000	91,200	101,000	.426	.48	6,010,000	B.
December	108,000	91,200	101,000	.426	.49	6,210,000	B.
The year	541,000	73,400	222,000	.937	12.72	161,000,000	
1886.							
January	182,000	[b] 63,000	95,300	.402	.46	5,860,000	B.
February	228,000	136,000	177,000	.747	.78	9,830,000	B.
March	130,000	106,000	118,000	.498	.57	7,260,000	B.
April	274,000	126,000	214,000	.903	1.01	12,700,000	B.
May	676,000	248,000	373,000	1.57	1.81	22,900,000	B.
June	765,000	513,000	653,000	2.76	3.08	38,900,000	B.
July	510,000	281,000	385,000	1.62	1.87	23,700,000	B.
August	276,000	146,000	203,000	.857	.99	12,500,000	B.
September	143,000	98,600	122,000	.515	.57	7,260,000	B.
October	97,300	74,400	84,400	.356	.41	5,190,000	B.
November	76,500	61,500	68,200	.288	.32	4,060,000	B.
December	88,800	60,800	73,900	.312	.36	4,540,000	B.
The year	765,000	60,800	214,000	.902	12.23	155,000,000	
1887.							
January	113,000	85,300	96,600	.408	.47	5,940,000	B.
February	104,000	64,700	73,900	.312	.32	4,100,000	B.
March	272,000	71,400	178,000	.751	.87	10,900,000	B.
April	300,000	243,000	273,000	1.15	1.28	16,200,000	B.
May	822,000	347,000	470,000	1.98	2.28	28,900,000	B.
June	1,040,000	813,000	932,000	3.93	4.38	55,500,000	B.
July	871,000	449,000	663,000	2.80	3.23	40,800,000	B.
August	438,000	234,000	309,000	1.30	1.50	19,000,000	B.
September	225,000	124,000	169,000	.713	.80	10,100,000	B.
October	123,000	97,300	111,000	.468	.54	6,820,000	B.
November	114,000	88,800	98,100	.414	.46	5,840,000	B.
December	112,000	86,400	97,200	.410	.47	5,980,000	B.
The year	1,040,000	64,700	289,000	1.22	16.60	210,000,000	
1888.							
January	219,000	48,500	79,000	.333	.38	4,860,000	C.
February	190,000	120,000	141,000	.595	.64	8,110,000	B.
March	133,000	99,900	117,000	.494	.57	7,190,000	B.
April	331,000	124,000	193,000	.814	.91	11,500,000	B.
May	460,000	300,000	399,000	1.68	1.94	24,500,000	B.
June	636,000	468,000	579,000	2.44	2.72	34,500,000	B.
July	505,000	276,000	370,000	1.56	1.80	22,800,000	B.
August	269,000	190,000	216,000	.911	1.05	13,300,000	B.
September	188,000	117,000	150,000	.633	.71	8,930,000	B.
October	116,000	87,600	99,900	.422	.49	6,140,000	B.
November	106,000	80,900	91,400	.386	.43	5,440,000	B.
December	92,400	76,500	84,000	.354	.41	5,160,000	B.
The year	636,000	48,500	210,000	.885	12.05	152,000,000	

[a] Gage heights for December 17 to 31, 1884, are very uncertain.
[b] Approximate gage heights January 19 to 23, 1886, are uncertain.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1889.							
January	74,400	61,500	64,900	0.274	0.32	3,990,000	B.
February	63,800	58,700	61,900	.261	.27	3,440,000	B.
March	108,000	62,200	86,800	.366	.42	5,340,000	B.
April	178,000	108,000	149,000	.629	.70	8,870,000	B.
May	316,000	188,000	267,000	1.13	1.30	16,400,000	B.
June	326,000	219,000	283,000	1.19	1.33	16,800,000	B.
July	217,000	164,000	181,000	.764	.88	11,100,000	B.
August	170,000	116,000	146,000	.616	.71	8,980,000	B.
September	117,000	76,500	94,300	.398	.44	5,610,000	B.
October	93,600	77,600	86,000	.363	.42	5,290,000	B.
November	86,400	67,400	75,900	.320	.36	4,520,000	B.
December	68,400	53,900	63,200	.267	.31	3,890,000	B.
The year	326,000	53,900	130,000	.548	7.46	94,200,000	
1890.							
January [a]	65,600	50,300	53,000	.224	.26	3,260,000	C.
February	198,000	60,800	115,000	.485	.50	6,390,000	B.
March	178,000	58,700	117,000	.494	.57	7,190,000	B.
April	323,000	141,000	194,000	.819	.91	11,500,000	B.
May	719,000	355,000	631,000	2.66	3.07	38,800,000	B.
June	600,000	432,000	488,000	2.06	2.30	29,000,000	B.
July	424,000	260,000	355,000	1.50	1.73	21,800,000	B.
August	257,000	153,000	195,000	.823	.95	12,000,000	B.
September	148,000	88,800	118,000	.498	.56	7,020,000	B.
October	93,600	82,000	87,500	.369	.43	5,380,000	B.
November	83,100	71,400	76,100	.321	.36	4,530,000	B.
December	72,400	63,800	68,100	.287	.33	4,190,000	B.
The year	719,000	50,300	208,000	.878	11.97	151,000,000	
1891.							
January	70,400	59,400	64,500	.272	.31	3,970,000	B.
February	69,400	58,000	61,400	.259	.27	3,410,000	B.
March	105,000	56,600	72,300	.305	.35	4,450,000	B.
April	223,000	86,400	136,000	.574	.64	8,090,000	B.
May	494,000	228,000	374,000	1.58	1.82	23,000,000	B.
June	502,000	421,000	468,000	1.97	2.20	27,800,000	B.
July	410,000	267,000	330,000	1.39	1.60	20,300,000	B.
August	262,000	155,000	208,000	.878	1.01	12,800,000	B.
September	155,000	105,000	128,000	.540	.60	7,620,000	B.
October	105,000	78,700	86,700	.366	.42	5,330,000	B.
November	129,000	83,100	104,000	.439	.49	6,190,000	B.
December	109,000	88,800	97,600	.412	.48	6,000,000	B.
The year	502,000	56,600	178,000	.749	10.19	129,000,000	
1892.							
January [b]	93,600	66,500	77,400	.327	.38	4,760,000	B.
February	83,300	64,800	71,500	.302	.33	4,110,000	A.
March	161,000	83,300	124,000	.523	.60	7,620,000	A.
April	176,000	124,000	150,000	.653	.71	8,930,000	A.
May	643,000	164,000	320,000	1.35	1.56	19,700,000	A.
June	688,000	542,000	615,000	2.59	2.89	36,600,000	B.
July	660,000	300,000	500,000	2.11	2.43	30,700,000	B.
August	296,000	157,000	214,000	.903	1.04	13,200,000	A.
September	155,000	127,000	141,000	.595	.66	8,390,000	A.
October	127,000	94,100	108,000	.456	.53	6,640,000	A.
November	115,000	89,600	96,300	.406	.45	5,730,000	A.
December	97,000	67,600	84,300	.356	.41	5,180,000	A.
The year	688,000	64,800	208,000	.878	11.99	152,000,000	
1893.							
January	91,400	68,300	76,100	.321	.37	4,680,000	A.
February	103,000	62,000	80,600	.340	.35	4,480,000	A.
March	112,000	62,000	69,500	.293	.34	4,270,000	A.
April	260,000	126,000	169,000	.713	.80	10,100,000	A.
May	696,000	264,000	492,000	2.08	2.40	30,300,000	B.
June	774,000	609,000	678,000	2.86	3.19	40,300,000	B.
July	597,000	439,000	523,000	2.21	2.55	32,200,000	B.
August	424,000	184,000	291,000	1.23	1.42	17,900,000	A.

[a] Discharge for January 3 to 16, 1890, interpolated. [b] Discharges based on gage heights at Cascade Locks.

NOTE.—Discharges for 1879 to 1891, inclusive, are based on gage heights at Cascade Locks.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1893.							
September	180,000	116,000	146,000	0.616	0.69	8,690,000	A.
October	146,000	106,000	119,000	.502	.58	7,320,000	A.
November	168,000	105,000	138,000	.582	.65	8,210,000	A.
December	221,000	115,000	164,000	.692	.80	10,100,000	A.
The year	774,000	62,000	246,000	1.04	14.14	179,000,000	
1894.							
January	223,000	100,000	143,000	.603	.70	8,790,000	A.
February	138,000	86,900	112,000	.473	.49	6,220,000	A.
March	304,000	110,000	163,000	.688	.79	10,000,000	A.
April	547,000	281,000	359,000	1.51	1.68	21,400,000	B.
May	1,200,000	441,000	655,000	2.76	3.18	40,300,000	B.
June	1,390,000	844,000	1,140,000	4.81	5.37	67,800,000	B.
July	816,000	417,000	625,000	2.64	3.04	38,400,000	B.
August [a]	412,000	221,000	287,000	1.21	1.40	17,600,000	B.
September [a]	221,000	133,000	174,000	.734	.82	10,400,000	B.
October [a]	135,000	121,000	129,000	.544	.63	7,930,000	B.
November [a]	152,000	126,000	133,000	.561	.63	7,910,000	B.
December [a]	136,000	86,400	111,000	.468	.54	6,820,000	B.
The year	1,390,000	86,400	336,000	1.42	19.27	244,000,000	
1895.							
January [a]	127,000	79,800	100,000	.422	.49	6,150,000	B.
February [a]	127,000	78,700	91,900	.388	.40	5,100,000	B.
March	133,000	103,000	116,000	.489	.56	7,130,000	A.
April	294,000	139,000	182,000	.768	.86	10,800,000	A.
May	535,000	300,000	417,000	1.76	2.03	25,600,000	B.
June	517,000	376,000	423,000	1.78	1.99	25,200,000	B.
July	437,000	279,000	383,000	1.62	1.87	23,600,000	B.
August	274,000	144,000	209,000	.882	1.02	12,900,000	A.
September [a]	144,000	105,000	125,000	.527	.59	7,440,000	B.
October [a]	104,000	83,100	94,500	.399	.46	5,810,000	B.
November [a]	84,200	72,400	77,100	.325	.36	4,590,000	B.
December [a]	77,600	68,400	73,700	.311	.36	4,530,000	B.
The year	535,000	68,400	191,000	.806	10.99	139,000,000	
1896.							
January [a]	121,000	68,400	88,700	.374	.43	5,450,000	B.
February [a]	123,000	82,000	92,200	.389	.42	5,300,000	B.
March	214,000	101,000	129,000	.544	.63	7,930,000	A.
April	208,000	148,000	179,000	.755	.84	10,700,000	A.
May	478,000	206,000	283,000	1.19	1.37	17,400,000	A.
June	900,000	542,000	774,000	3.27	3.65	46,100,000	B.
July	892,000	430,000	727,000	3.07	3.54	44,700,000	B.
August	413,000	190,000	270,000	1.14	1.31	16,600,000	A.
September	190,000	110,000	154,000	.650	.73	9,160,000	A.
October [b]	.....	.....	99,000	.418	.48	6,090,000	C.
November [c]	194,000	.....	124,000	.523	.58	7,380,000	B.
December [a]	214,000	99,900	161,000	.679	.78	9,900,000	B.
The year	900,000	68,400	257,000	1.08	14.76	187,000,000	
1897.							
January [a]	130,000	96,000	112,000	.473	.55	6,890,000	B.
February [b]	.....	.....	96,000	.405	.42	5,330,000	C.
March [a]	210,000	83,100	107,000	.451	.52	6,580,000	B.
April	566,000	126,000	324,000	1.37	1.53	19,300,000	A.
May	895,000	503,000	710,000	3.00	3.46	43,700,000	B.
June	844,000	501,000	612,000	2.58	2.88	36,400,000	B.
July	508,000	277,000	412,000	1.74	2.01	25,300,000	B.
August	268,000	192,000	213,000	.899	1.04	13,100,000	A.
September	188,000	100,000	135,000	.570	.64	8,030,000	A.
October	104,000	84,200	95,300	.402	.46	5,860,000	A.
November	162,000	80,600	111,000	.468	.52	6,600,000	A.
December	165,000	114,000	137,000	.578	.67	8,420,000	A.
The year	895,000	80,600	255,000	1.08	14.70	186,000,000	

[a] Discharges based on gage heights at Cascade Locks. [b] Estimated. [c] Partly estimated.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1898.							
January	151,000	83,300	111,000	0.468	0.54	6,820,000	A.
February	274,000	81,500	146,000	.616	.64	8,110,000	A.
March	180,000	110,000	144,000	.608	.70	8,850,000	A.
April	369,000	108,000	207,000	.873	.97	12,300,000	A.
May	673,000	359,000	469,000	1.98	2.28	28,800,000	B.
June	737,000	619,000	684,000	2.89	3.22	40,700,000	B.
July	612,000	324,000	445,000	1.88	2.17	27,400,000	B.
August	312,000	203,000	246,000	1.04	1.20	15,100,000	A.
September	200,000	113,000	140,000	.591	.66	8,330,000	A.
October	111,000	84,200	95,500	.403	.46	5,870,000	A.
November	86,000	77,000	82,200	.347	.39	4,890,000	A.
December	83,300	57,200	67,400	.284	.33	4,140,000	A.
The year	737,000	57,200	236,000	.998	13.56	171,000,000	
1899.							
January	138,000	69,800	96,200	.406	.47	5,920,000	A.
February	126,000	78,800	107,000	.451	.47	5,940,000	A.
March	123,000	92,300	104,000	.439	.51	6,400,000	A.
April	255,000	116,000	194,000	.819	.91	11,500,000	A.
May	528,000	201,000	334,000	1.41	1.63	20,500,000	A.
June	903,000	530,000	726,000	3.06	3.41	43,200,000	B.
July	830,000	503,000	698,000	2.95	3.40	42,900,000	B.
August	489,000	239,000	331,000	1.40	1.61	20,400,000	A.
September	237,000	165,000	194,000	.819	.91	11,500,000	A.
October	165,000	122,000	136,000	.574	.66	8,360,000	A.
November	164,000	109,000	126,000	.532	.59	7,500,000	A.
December	194,000	128,000	154,000	.650	.75	9,470,000	A.
The year	903,000	69,800	267,000	1.13	15.32	194,000,000	
1900.							
January	262,000	134,000	166,000	.700	.81	10,200,000	A.
February	138,000	101,000	122,000	.515	.54	6,780,000	A.
March	237,000	128,000	187,000	.789	.91	11,500,000	A.
April	328,000	220,000	289,000	1.22	1.36	17,200,000	A.
May	619,000	312,000	505,000	2.13	2.46	31,100,000	B.
June	496,000	424,000	459,000	1.94	2.16	27,300,000	B.
July	491,000	248,000	352,000	1.49	1.72	21,600,000	B.
August	248,000	148,000	188,000	.793	.91	11,600,000	A.
September	154,000	116,000	132,000	.557	.62	7,860,000	A.
October	133,000	97,000	111,000	.468	.54	6,820,000	A.
November	138,000	104,000	121,000	.511	.57	7,200,000	A.
December	178,000	108,000	135,000	.570	.66	8,300,000	A.
The year	619,000	97,000	231,000	.974	13.26	167,000,000	
1901.							
January	157,000	106,000	126,000	.532	.61	7,750,000	A.
February	208,000	79,700	120,000	.506	.53	6,660,000	A.
March	285,000	148,000	188,000	.793	.91	11,600,000	A.
April	213,000	133,000	162,000	.684	.76	9,640,000	A.
May	735,000	206,000	478,000	2.02	2.33	29,400,000	B.
June	753,000	452,000	583,000	2.46	2.74	34,700,000	B.
July	462,000	306,000	374,000	1.58	1.82	23,000,000	B.
August	300,000	164,000	224,000	.945	1.09	13,800,000	A.
September	162,000	97,000	129,000	.544	.61	7,680,000	A.
October	99,000	75,400	84,200	.355	.41	5,180,000	A.
November	92,300	75,400	82,400	.348	.39	4,900,000	A.
December	111,000	76,200	90,700	.383	.44	5,580,000	A.
The year	753,000	75,400	220,000	.929	12.64	160,000,000	
1902.							
January	100,000	69,000	86,700	.366	.42	5,330,000	A.
February	136,000	57,200	98,600	.416	.43	5,480,000	A.
March	137,000	89,600	108,000	.456	.53	6,640,000	A.
April	194,000	86,900	141,000	.595	.66	8,400,000	A.
May	722,000	176,000	393,000	1.66	1.91	24,200,000	B.
June	732,000	484,000	607,000	2.56	2.86	36,100,000	B.
July	544,000	352,000	455,000	1.92	2.21	28,000,000	B.
August	342,000	174,000	239,000	1.01	1.16	14,700,000	A.
September	168,000	97,000	122,000	.515	.57	7,260,000	A.
October	93,200	74,600	82,100	.346	.40	5,050,000	A.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1902.							
November	91,400	73,800	83,400	0.352	0.39	4,960,000	A.
December	99,000	70,600	83,700	.353	.41	5,150,000	A.
The year	732,000	57,200	208,000	.879	11.95	151,000,000	
1903.							
January	177,000	84,200	114,000	.481	.55	7,010,000	A.
February	122,000	72,200	85,900	.362	.38	4,770,000	A.
March	192,000	73,000	95,500	.403	.46	5,870,000	A.
April	264,000	157,000	191,000	.806	.90	11,400,000	A.
May	415,000	250,000	334,000	1.41	1.63	20,500,000	A.
June	903,000	428,000	779,000	3.29	3.67	46,400,000	B.
July	730,000	312,000	475,000	2.00	2.31	29,200,000	B.
August	306,000	172,000	220,000	.928	1.07	13,500,000	A.
September	170,000	126,000	145,000	.612	.68	8,630,000	A.
October	171,000	131,000	151,000	.637	.73	9,280,000	A.
November	138,000	119,000	129,000	.544	.61	7,680,000	A.
December	131,000	95,000	118,000	.498	.57	7,260,000	A.
The year	903,000	72,200	236,000	.998	13.56	172,000,000	
1904.							
January	106,000	87,800	97,600	.412	.48	6,000,000	A.
February	162,000	78,800	98,400	.415	.45	5,660,000	A.
March	259,000	115,000	167,000	.705	.81	10,300,000	A.
April	540,000	161,000	368,000	1.55	1.73	21,900,000	B.
May	714,000	501,000	574,000	2.42	2.79	35,300,000	B.
June	683,000	526,000	633,000	2.67	2.98	37,700,000	B.
July	526,000	275,000	442,000	1.86	2.14	27,200,000	B.
August	266,000	143,000	202,000	.852	.98	12,400,000	A.
September	139,000	96,000	119,000	.502	.56	7,080,000	A.
October	94,100	73,800	83,200	.351	.40	5,120,000	A.
November	77,000	66,900	71,100	.300	.33	4,230,000	A.
December	77,000	64,800	70,200	.296	.34	4,320,000	A.
The year	714,000	64,800	244,000	1.03	13.99	177,000,000	
1905.							
January	78,800	56,600	65,200	.275	.32	4,010,000	B.
February	73,800	51,800	61,700	.260	.27	3,430,000	B.
March	126,000	77,000	104,000	.439	.51	6,400,000	A.
April	188,000	111,000	128,000	.540	.60	7,620,000	A.
May	264,000	170,000	208,000	.878	1.01	12,800,000	A.
June	462,000	285,000	394,000	1.66	1.85	23,400,000	B.
July	338,000	205,000	257,000	1.08	1.24	15,800,000	A.
August	206,000	120,000	173,000	.730	.84	10,600,000	A.
September	117,000	76,200	93,600	.395	.44	5,570,000	A.
October	112,000	90,500	101,000	.426	.49	6,210,000	A.
November	91,400	72,200	77,500	.327	.36	4,610,000	A.
December	74,600	61,400	65,900	.278	.32	4,050,000	B.
The year	462,000	61,400	144,000	.607	8.25	104,000,000	
1906.							
January	70,600	58,400	62,300	.263	.30	3,830,000	B.
February	100,000	62,700	75,100	.317	.33	4,170,000	A.
March	154,000	72,200	90,500	.382	.44	5,560,000	A.
April	279,000	162,000	205,000	.865	.97	12,200,000	A.
May	380,000	272,000	322,000	1.36	1.57	19,800,000	A.
June	415,000	298,000	363,000	1.53	1.71	21,600,000	B.
July	324,000	235,000	296,000	1.25	1.44	18,200,000	A.
August	228,000	122,000	166,000	.700	.81	10,200,000	A.
September	127,000	98,000	112,000	.473	.53	6,660,000	A.
October	106,000	84,200	90,100	.380	.44	5,540,000	A.
November	274,000	90,500	135,000	.570	.64	8,030,000	A.
December	151,000	103,000	120,000	.506	.58	7,380,000	A.
The year	415,000	58,400	170,000	.716	9.76	123,000,000	
1907.							
January	138,000	76,200	102,000	.430	.50	6,270,000	A.
February	214,000	110,000	155,000	.654	.68	8,610,000	A.
March	262,000	125,000	165,000	.696	.80	10,100,000	A.
April	310,000	152,000	243,000	1.03	1.15	14,500,000	A.
May	590,000	259,000	419,000	1.77	2.04	25,800,000	B.

Monthly discharge of Columbia River at The Dalles, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
June	666,000	542,000	601,000	2.54	2.83	35,800,000	B.
July	602,000	330,000	482,000	2.03	2.34	29,600,000	B.
August	330,000	177,000	238,000	1.00	1.15	14,600,000	A.
September	179,000	131,000	159,000	.671	.75	9,460,000	A.
October	131,000	94,100	113,000	.477	.55	6,950,000	A.
November	93,200	82,400	86,800	.366	.41	5,160,000	A.
December	115,000	76,200	86,800	.366	.42	5,340,000	A.
The year	666,000	76,200	238,000	1.00	13.62	172,000,000	
1908.							
January	86,000	64,800	73,700	.311	.36	4,530,000	A.
February	68,300	59,000	65,000	.274	.30	3,740,000	B.
March	230,000	68,300	114,000	.481	.55	7,010,000	A.
April	328,000	107,000	187,000	.789	.88	11,100,000	A.
May	448,000	285,000	379,000	1.60	1.84	23,300,000	B.
June	743,000	446,000	607,000	2.56	2.86	36,100,000	B.
July	578,000	344,000	462,000	1.95	2.25	28,400,000	B.
August	336,000	152,000	207,000	.873	1.01	12,700,000	A.
September	151,000	100,000	118,000	.498	.56	7,020,000	A.
October	100,000	82,400	88,900	.375	.43	5,470,000	A.
November	95,000	81,500	86,400	.365	.41	5,140,000	A.
December	89,600	65,500	76,800	.324	.37	4,720,000	A.
The year	743,000	59,000	205,000	.867	11.82	149,000,000	

Yearly discharge of Columbia River at The Dalles, Oreg., for thirty years.

[Drainage area, 237,000 square miles.]

Year.	Discharge in second-feet.						Run-off.		Per cent variation from mean.
	Maximum.	Minimum.	Highest monthly mean.	Lowest monthly mean.	Mean.	Mean per square mile.	Depth in inches.	Acre-feet.	
1879	789,000	65,600	751,000	73,300	295,000	1.24	16.94	214,000,000	+25.6
1880	1,130,000	74,400	973,000	83,400	322,000	1.36	18.54	234,000,000	+37.0
1881	742,000	87,600	686,000	97,000	309,000	1.31	17.70	224,000,000	+31.5
1882	1,090,000	67,400	947,000	74,900	281,000	1.19	16.13	204,000,000	+19.6
1883	704,000	65,600	657,000	82,500	245,000	1.04	14.10	178,000,000	+ 4.3
1884	795,000	50,300	736,000	80,400	248,000	1.05	14.27	180,000,000	+ 5.5
1885	541,000	73,400	497,000	91,000	222,000	.937	12.72	161,000,000	− 5.5
1886	765,000	60,800	653,000	68,200	214,000	.902	12.23	155,000,000	− 8.9
1887	1,040,000	64,700	932,000	73,900	289,000	1.22	16.60	210,000,000	+23.0
1888	636,000	48,500	579,000	79,000	210,000	.885	12.05	152,000,000	−10.6
1889	326,000	53,900	283,000	61,900	130,000	.548	7.46	94,200,000	−44.7
1890	719,000	50,300	631,000	53,000	208,000	.878	11.97	151,000,000	−11.5
1891	502,000	56,600	468,000	61,400	178,000	.749	10.19	129,000,000	−24.2
1892	688,000	64,800	615,000	71,500	208,000	.878	11.99	152,000,000	−11.5
1893	774,000	62,000	678,000	69,500	246,000	1.04	14.14	179,000,000	+ 4.7
1894	1,390,000	86,400	1,140,000	111,000	336,000	1.42	19.27	244,000,000	+43.0
1895	535,000	68,400	423,000	73,700	191,000	.806	10.99	139,000,000	−18.7
1896	900,000	68,400	774,000	88,700	257,000	1.08	14.76	187,000,000	+ 9.4
1897	895,000	80,600	710,000	95,300	255,000	1.08	14.70	186,000,000	+ 8.5
1898	737,000	57,200	684,000	67,400	236,000	.998	13.56	171,000,000	+ 0.4
1899	903,000	69,800	726,000	96,200	267,000	1.13	15.32	194,000,000	+13.6
1900	619,000	97,000	505,000	111,000	231,000	.974	13.26	167,000,000	− 1.7
1901	753,000	75,400	583,000	82,400	220,000	.929	12.64	160,000,000	− 6.4
1902	732,000	57,200	607,000	82,100	208,000	.879	11.95	151,000,000	−11.5
1903	903,000	72,200	779,000	85,900	236,000	.998	13.56	172,000,000	+ 0.4
1904	714,000	64,800	633,000	70,200	244,000	1.03	13.99	177,000,000	+ 3.8
1905	462,000	61,400	394,000	61,700	144,000	.607	8.25	104,000,000	−38.7
1906	415,000	58,400	363,000	62,300	170,000	.716	9.76	123,000,000	−27.6
1907	666,000	76,200	601,000	86,800	238,000	1.00	13.62	172,000,000	+ 1.3
1908	743,000	59,000	607,000	65,000	205,000	.867	11.82	149,000,000	−12.8
Mean	754,000	66,600	654,000	78,700	235,000	.991	13.48	170,000,000	.....

Mean discharge of Columbia River at The Dalles, Oreg., for successive ten-year periods.

Period.	Yearly means.	Variation from 30-year mean.	Means of minimum months.	Variation from 30-year mean.
	Sec.-feet.	*Per cent.*	*Sec.-feet.*	
1879–1888	264,000	+12.3	80,400	+ 2.2
1880–1889	247,000	+ 5.1	79,200	+ .6
1881–1890	236,000	+ 0.4	76,200	− 3.2
1882–1891	222,000	− 5.5	72,600	− 7.8
1883–1892	215,000	− 8.5	72,300	− 8.1
1884–1893	215,000	− 8.5	71,000	− 9.8
1885–1894	224,000	− 4.7	74,000	− 6.0
1886–1895	221,000	− 6.0	72,300	− 8.1
1887–1896	225,000	− 4.3	74,400	− 5.5
1888–1897	222,000	− 5.5	76,500	− 2.8
1889–1898	224,000	− 4.7	75,300	− 4.3
1890–1899	238,000	+ 1.3	78,800	+ .1
1891–1900	240,000	+ 2.1	84,600	+ 7.4
1892–1901	245,000	+ 4.3	86,700	+10.2
1893–1902	245,000	+ 4.3	87,700	+11.4
1894–1903	244,000	+ 3.8	89,300	+13.5
1895–1904	234,000	− 0.4	85,300	+ 8.4
1896–1905	230,000	− 2.1	84,100	+ 6.9
1897–1906	221,000	− 6.0	81,400	+ 3.4
1898–1907	219,000	− 6.8	80,600	+ 2.4
1899–1908	216,000	− 8.1	80,400	+ 2.2
1879–1908	235,000	.....	78,700	.....

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made on minor streams directly tributary to Columbia River during 1907–8:

Miscellaneous measurements in Columbia River drainage basin in 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
September 6, 1907	Klickitat River	Columbia River	Wright, Wash	[a], [b] − 6.27	1,050
September 5, 1907	Little Klickitat River.	Klickitat River	Goldendale, Wash	[b] − 3.48	15
Do	do	do	Blockhouse, Wash	[b], [c] − 4.51	29
Do	Mill Creek	Little Klickitat River.	do	([b])	[d] 4
Do	Spring Creek	do	do	([b])	[d] 8
Do	Bowman Creek	do	do	([b])	[d] 1
September 6, 1907	Swail Canyon Creek.	Klickitat River	Wright, Wash	.....	0
September 7, 1907	White Salmon River	Columbia River	Underwood, Wash	[b], [e] − 5.37	909
September 8, 1907	Wind River	do	Carson, Wash., 2 miles above mouth.	[b], [f] − 19.18	190
July 4, 1908	Multnomah Creek	do	Mouth	[b], [g] − .66	15
August 13, 1907	North Fork of Lewis River.	do	Sec. 24, T. 7 N., R. 6 E., 300 feet above Muddy Creek.	[h] − 11.7	404
July 6, 1907	do	do	Cressups Ferry, Washington.	− 8.5	1,510
September 21, 1907	do	do	do	.....	1,350
August 13, 1907	Muddy Creek	North Fork of Lewis River.	Sec. 24, T. 7 N., R. 6 E., Washington.	[i] − 12.6	220
July 10, 1907	Canyon Creek	do	Mouth, Washington	.....	71
May 27, 1907	North Fork of Toutle River.	Cowlitz River	Outlet of Spirit Lake, Washington.	.....	206

[a] Below top of railroad spike in downstream end of right abutment.
[b] Low water.
[c] Below an 8-penny nail in top of 10-inch alder stump on right bank, 75 feet above mouth.
[d] Estimated.
[e] Below top of bridge pier right side, at county highway bridge, 600 feet above mouth.
[f] Below top of first floor beam from right end of bridge, upstream side.
[g] Below cross in northeast vertical face of small boulder on right bank, 53.5 feet above old railroad bridge.
[h] Below reference point on 24-inch fir on right bank.
[i] Below reference point on cedar 18 inches in diameter on left bank, gaged 400 feet above mouth.

Miscellaneous measurements in Columbia River drainage basin in 1907 and 1908—Con.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
May 26, 1907	North Fork of Toutle River.	Cowlitz River	Aschans ranch, Washington.		509
May 25, 1907	do	do	Kid Valley, Washington.		961
May 24, 1907	South Fork of Toutle River.	do	Toutle, Wash		336
October 3, 1908	Big Creek	Columbia River	Sec. 14, T. 7 N., R. 7 W., Oregon.		2.8
Do	do	do	2 miles southeast of Knappa, Oreg.	[a] −9.29	32
October 2, 1908	Yellowstone Creek	Big Creek	Sec. 14, T. 7 N., R. 7 W., Oregon, near mouth.	[b] −4.4	3.2

[a] Below notch in a board 22.8 feet from west end of suspension bridge.
[b] Below notch in alder on right bank.

CLARK FORK DRAINAGE BASIN.

DESCRIPTION.

Clark Fork of Columbia River rises in the Silverbow Mountains, Montana, about 18 miles southwest of Butte. For about 40 miles it flows northward, but near Garrison, near Powell County, it turns to the northwest and maintains this general course through a distance of about 125 miles until it reaches St. Regis, in Missoula County, where it turns abruptly to the northeast. At Paradise, in Sanders County, it resumes its northwesterly course, passing between the Cœur d'Alene and Cabinet ranges, crossing the "panhandle" of Idaho in Bonner County, flowing through Lake Pend Oreille, and entering Washington near the town of Newport in Stevens County. From Usk to the international boundary line its course is northward, and just beyond the boundary it turns and flows directly west to its junction with the Columbia. From source to mouth, its length, exclusive of windings, is, roughly, 420 miles, and its drainage area measures 25,800 square miles.

To the river thus described various names have been applied in the past[a] and may still be used locally. The Bitterroot in this decision refers to a portion of the main stream so called, and not to the tributary known as the Bitterroot River.

The Land Office maps of Montana, Idaho, and Washington on which the Clark Fork drainage area is shown indicates more than 150 tributary streams, but by far the greater number of these are very short, and scarcely a dozen can be called rivers. The most important are listed in the table following.

[a] Clark Fork; river in Idaho, Montana, and Washington. (Not Bitter Root, Bitterroot, Clarke, Clarks River, Deer Lodge, Deerlodge, Hell Gate, Hellgate, Missoula, Silver Bow, nor Silverbow.)
See Third Report U. S. Board of Geographic Names, Washington, 1907, p. 51.

Principal tributaries of Clark Fork of Columbia River.

From the south and west.	From the north and east.
Flint Creek.	Little Blackfoot River.
Rock Creek.	Big Blackfoot River.
Bitterroot River.	Flathead River.
	Thompson River.
	Vermillion Creek.
	Priest River.
	Salmon River (British Columbia).

The river leaves the Silverbow Mountains near the Continental Divide at an elevation of about 5,000 feet above sea level and flows through a valley 3 or 4 miles wide, bounded by rolling hills. At Garrison it is 4,300 feet above sea. From Garrison the valley gradually narrows to a mile or less at Missoula (elevation 3,200 feet), broadens out just west of Missoula near the mouth of the Bitterroot, and again narrows as the river approaches the Mission Range. Many of the peaks in this range exceed 8,000 feet in altitude. At Paradise the stream is about 2,500 feet above sea level, and at Pend Oreille Lake the elevation is but 1,900 feet.

Much of the region drained by Clark Fork and its tributaries is well timbered, especially in the mountains, and the drainage area includes parts of the Lewis and Clark, Helena, Hell Gate, Missoula, Lolo, Bitterroot, Cœur d'Alene, and Cabinet national forests.

As might be expected, a great deal of snow lies in the mountains from November to June, and many of the streams are frozen over in the colder months. During the greater part of the year, however, the streams are open, because of the milder climate on the western slope of the Continental Divide.

Irrigation in the Bitterroot Valley has been developed quite extensively. A large private enterprise near Hamilton is now nearing completion. The United States Reclamation Service is irrigating the Flathead Indian Reservation by diverting water from the smaller streams. A project to dam Flathead River and develop power for pumping water from the lake is now under way. One hundred thousand acres will be irrigated on the Flathead.

Reservoir sites available for storage are numerous. The Mission Range has several that will be used by the Reclamation Service; also good storage reservoir sites are to be found on the Bitterroot and upper Little Bitterroot.

The drainage basin contains many valuable power streams. On a few streams power plants have already been installed and more are under construction.

The run-off records extend back to 1898. During this period, 1899 was the wettest year and 1905 was the dryest.

The following gaging stations have been maintained in this river basin (all in Montana except as indicated):

Clark Fork at Missoula, Mont. (1898–1907).
Clark Fork at Priest River, Idaho (1903–1905).
Clark Fork at Newport, Wash. (1904–1908).
Big Blackfoot at Bonner (1898–1905).
Bitterroot near Grantsdale (1902–1907).
Bitterroot near Missoula (1898–1904).
Flathead Lake at Holt (year 1900).
Flathead Lake at Polson (1900, 1901, and 1908).
Flathead River near Polson (1907–1908).
Stillwater near Kalispell (1906–1907—4 months).
Whitefish near Kalispell (1906).
Little Bitterroot Creek near Dayton (1908).
Crow Creek near Ronan (1906–1908).
Mud Creek near Ronan (1908).
Mission Creek near St. Ignatius (1906–1908).
Dry Creek near St. Ignatius (1908).
Post Creek near St. Ignatius (1906–1908).
Jocko River near Jocko (1908).
Jocko River at Ravalli (1906–1908).
Big Knife Creek near Jocko (1908).
Agency Creek near Jocko (1908).
Finley Creek near Jocko (1908).
East Finley Creek near Jocko (1908).
The Indian Ditch near Jocko (1908).
Valley Creek near Ravalli, Mont. (1908).

Miscellaneous measurements.

Spring Creek at Ronan (1908).
Finley Creek at Arlee (1908).
Pablos Ditch near Ronan (1908).
North Fork of Post Creek (1908).

CLARK FORK AT MISSOULA, MONT.

This station was established July 10, 1898, at Higgins Avenue Bridge, Missoula, Mont., but was removed May 27, 1899, to the bridge of the Bitterroot Valley division of the Northern Pacific Railway, about one-half mile downstream. The gage datum has remained unchanged since the gage was removed. The records supply data for power, irrigation, and general statistical purposes. The station was discontinued July 1, 1907.

The drainage area at Missoula, including the area drained by the Big Blackfoot and the main stream and its smaller tributaries is 5,960 square miles. Just below Missoula, the Bitterroot enters the river and about 100 miles below is the mouth of the Flathead. From the source of the stream there are many small water rights, the water being used for irrigation. At Bonner, where the Big Blackfoot

enters, the Missoula Light and Power Company develop 5,000 ultimate horsepower and are entitled to the entire flow of the river. Another plant is under construction on the Big Blackfoot.

As the climate is mild, this stream usually freezes only partly over during the colder months.

Estimates at this station are subject to slight error. The swiftness of the river at high stages may cause the channel to shift. In low water it is comparatively sluggish.

Undoubtedly the greatest crest flow occurred in June, 1908, but no records are obtainable.

The following measurement was made May 1, 1907: Width, 280 feet; area, 1,260 square feet; gage height, 5.50 feet; discharge, 5,070 second-feet.

Daily gage height, in feet, of Clark Fork at Missoula, Mont., for 1907.

[Thomas E. Westby, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1			4.12	5.15	5.52	7.72	16			3.82	6.62	7.28	7.42
2			4.00	5.62	5.45	8.25	17	2.22		3.75	6.58	7.82	7.18
3			3.90	6.10	5.40	8.32	18			3.80	6.48	8.25	7.65
4	2.98		3.75	6.22	5.40	8.15	19			4.40	6.25	8.52	7.85
5			3.72	6.00	5.40	8.05	20			5.52	6.02	8.85	7.40
6			3.80	5.62	5.40	8.20	21			6.25	5.88	8.98	7.18
7		3.88	3.82	5.25	5.45	8.30	22			6.15	5.78	8.62	7.58
8			3.85	5.28	5.58	8.52	23		4.85	5.65	5.88	8.30	8.02
9	2.58		3.90	5.52	5.85	8.42	24	3.78	4.92	5.30	5.98	7.95	8.68
10			3.98	6.02	6.28	7.98	25		5.00	5.00	5.95	7.72	8.58
11			3.92	6.10	6.68	7.58	26		4.65	4.68	5.95	7.30	8.58
12			3.92	6.05	7.05	7.72	27		4.38	4.45	5.78	7.02	8.55
13			3.82	5.95	7.00	7.80	28		4.18	4.48	5.70	7.00	8.50
14		4.22	3.82	6.18	7.00	7.62	29			4.42	5.60	7.08	8.50
15			3.78	6.48	6.92	7.42	30			4.32	5.55	7.15	8.50
							31	3.68		4.25		7.35	

NOTE.—River frozen over January 1 to February 22. During this time there was an open channel in the center of varying width. The gage heights for this period were taken to the water surface through a hole in the ice. The thickness of ice varied from 0.3 to 1.1 feet.

Rating table for Clark Fork at Missoula, Mont., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	1,930	4.70	3,420	5.70	5,810	7.40	12,100
3.80	2,050	4.80	3,620	5.80	6,100	7.60	12,900
3.90	2,170	4.90	3,830	5.90	6,400	7.80	13,700
4.00	2,300	5.00	4,050	6.00	6,710	8.00	14,500
4.10	2,430	5.10	4,280	6.20	7,370	8.20	15,300
4.20	2,570	5.20	4,510	6.40	8,110	8.40	16,100
4.30	2,720	5.30	4,750	6.60	8,900	8.60	16,900
4.40	2,880	5.40	5,000	6.80	9,700	8.80	17,700
4.50	3,050	5.50	5,260	7.00	10,500	9.00	18,500
4.60	3,230	5.60	5,530	7.20	11,300		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on sixteen discharge measurements made during 1904–7, and is fairly well defined.

Monthly discharge of Clark Fork at Missoula, Mont., for 1907.

[Drainage area, 5,960 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January			[a] 770	0.129	0.15	7,300	D.
February			[a] 1,700	.285	.30	94,400	C.
March	7,550	1,950	3,010	.505	.58	185,000	B.
April	8,980	4,400	6,540	1.10	1.23	389,000	B.
May	18,400	5,000	10,500	1.76	2.04	646,000	B.
June	17,200	11,200	14,500	2.43	2.71	863,000	B.
The period						2,180,000	

[a] Estimated.

CLARK FORK AT PRIEST RIVER, IDAHO, AND NEWPORT, WASH.

The Priest River station on Clark Fork was established June 26, 1903, but was discontinued April 30, 1905. It was located 1,000 feet downstream from Priest River railroad station and one-fourth mile below the mouth of Priest River.

Gage records were begun at Newport, Wash., by the United States Weather Bureau in April, 1904, and they have been continuous from that date except for the months of December, January, and February during the last three winters. The winter records are complete for 1903–4, 1904–5, and 1905–6.

By comparing simultaneous gage readings at Priest River and Newport from April, 1904, to April, 1905, a very satisfactory relation has been established. The monthly discharges of Clark Fork at Priest River have also been compared with those of Columbia River during the winter months when records were obtained at both stations, the following percentages being obtained.

Comparison of the flow of Clark Fork at Priest River with that of Columbia River at The Dalles.

	December.	January.	February.
	Per cent.	*Per cent.*	*Per cent.*
1903–4	14.0	13.5	11.2
1904–5	11.7	12.0	11.9
1905–6	12.9	12.0	11.0
Mean	12.9	12.5	11.4

In this manner complete records of Clark Fork at Priest River have been obtained since June 26, 1903. The rating table for Newport is based upon measurements made at Priest River and has been applied from May 1, 1905, to December 31, 1908. Gage heights at

Newport have been published in the Weather Bureau reports of "Daily river stages of the principal rivers of the United States" as follows:

1904, Part VII, page 184.
1905–6, Part VIII, page 68.

Discharge measurements of Clark Fork at Priest River, Idaho, in 1903, 1904, and 1905.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 26	T. A. Noble		22,400	59.40	126,000
July 15	G. H. Bliss		14,100	53.85	72,000
August 6	do		9,440	48.48	38,900
September 3	do		6,290	45.15	17,800
October 28	do		5,920	44.81	16,200
1904.					
March 12	C. E. Hewett	790	5,720	44.39	14,300
May 27	W. G. Steward	948	16,700	56.00	89,400
July 20	do	905	10,600	49.92	45,300
August 11	do	845	7,230	46.33	22,800
1905.					
January 19 [a]	Laurgaard and Costeel	715	3,900	42.52	7,850
February 3 [b]	C. Costeel	704	3,500	41.85	5,419

[a] River one-fourth frozen over. [b] River frozen 400 feet along north bank.

Daily gage height, in feet, of Clark Fork at Newport, Wash., for 1907 and 1908.

[United States Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1			1.8	2.3	6.5	14.6	15.7	9.0	4.9	1.3	1.0	
2			1.8	2.2	6.5	14.7	15.8	9.5	4.5	1.2	.7	
3			1.8	2.2	6.4	14.8	15.8	9.4	4.2	1.2	.4	
4			1.8	2.3	6.4	15.0	15.8	9.3	4.1	1.1	.2	
5			1.8	2.4	6.4	15.3	15.7	9.3	3.9	1.1	.1	
6			1.8	2.5	6.4	15.4	15.7	9.1	3.8	1.0	.1	
7			1.8	2.7	6.4	15.7	15.6	9.0	3.7	1.0	.0	
8			1.8	2.8	6.5	15.8	15.4	8.9	3.6	.0	.0	
9			1.8	2.9	6.7	16.0	15.2	8.9	3.5	−0.9	−.1	
10			1.7	3.0	6.9	16.2	15.0	8.8	3.4	− .8	−.1	
11			1.7	3.2	7.5	16.5	14.8	8.7	3.3	− .8	−.2	
12			1.6	3.2	7.8	16.6	14.5	8.5	3.2	− .8	−.2	
13			1.5	3.3	8.0	16.6	14.2	8.4	3.1	− .7	−.3	
14			1.4	4.0	8.2	16.6	13.8	8.3	3.1	− .7	−.4	
15			1.4	4.1	8.5	16.7	13.5	8.1	3.1	− .7	−.4	
16			1.3	4.5	8.8	16.3	13.3	7.9	3.1	− .7	−.4	
17			1.3	4.9	9.3	16.6	12.9	7.8	2.9	− .6	−.4	
18			1.3	5.2	9.7	16.5	12.6	7.6	2.9	− .6	−.5	
19			1.2	5.5	10.4	16.3	12.3	7.4	2.9	− .6	−.5	
20			1.2	5.7	11.2	16.0	12.0	7.2	2.9	− .5	−.6	
21			1.3	5.8	12.0	15.8	11.7	7.0	2.8	− .5	−.6	
22			1.4	5.9	12.7	15.7	11.4	7.0	2.7	− .5	−.6	
23			1.7	6.2	13.3	15.6	11.0	6.9	2.6	− .4	−.6	
24			2.0	6.3	13.7	15.6	10.8	6.8	2.4	− .4	−.6	
25			2.2	6.5	14.1	15.6	10.5	6.5	2.3	− .4	−.6	
26			2.3	6.5	14.4	15.6	10.0	6.4	2.1	− .4	−.5	
27			2.3	6.6	14.5	15.7	9.7	6.2	1.8	− .4	−.5	
28			2.3	6.5	14.5	15.6	9.3	6.0	1.6	− .3	−.5	
29			2.3	6.5	14.6	15.7	8.9	5.7	1.4	− .2	−.5	
30			2.3	6.5	14.6	15.7	8.5	5.4	1.3	− .1	−.5	
31			2.3		14.6		8.3	5.2		− .1		

Daily gage height, in feet, of Clark Fork at Newport, Wash., for 1907 and 1908—Cont'd.

[United States Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	.....	.....	−0.9	0.8	7.7	12.1	17.0	6.5	1.1	−0.5	+0.2	.....
2	.....	.....	− .8	.8	7.8	12.1	16.0	6.3	1.1	− .4	.2	.....
3	.....	.....	− .8	.8	7.9	12.5	15.4	6.1	1.0	− .5	.2	.....
4	.....	.....	− .7	.8	8.0	12.8	14.5	5.6	.8	− .5	.2	.....
5	.....	.....	− .6	.8	8.1	13.1	14.0	5.4	.7	− .6	.2	.....
6	.....	.....	− .6	.8	8.4	13.9	14.0	5.1	.7	− .7	.2	.....
7	.....	.....	− .5	.8	8.6	14.6	13.8	4.8	.6	− .8	.1	.....
8	.....	.....	− .5	.8	9.0	15.2	13.4	4.6	.6	− .8	.1	.....
9	.....	.....	− .5	.8	9.4	16.4	13.0	4.4	.6	− .8	.1	.....
10	.....	.....	− .5	.8	9.8	17.4	12.5	4.0	.6	− .8	.1	.....
11	.....	.....	− .4	.9	10.0	18.5	12.0	3.7	.5	− .7	.1	.....
12	.....	.....	− .4	.9	10.1	19.0	11.5	3.5	.4	− .7	.1	.....
13	.....	.....	− .4	1.0	10.4	20.0	11.0	3.4	.4	− .6	.1	.....
14	.....	.....	− .3	1.1	10.6	20.6	10.6	3.1	.4	− .5	.0	.....
15	.....	.....	− .3	1.2	11.0	21.2	10.1	3.0	.4	− .4	.0	.....
16	.....	.....	− .3	1.4	10.9	21.7	9.6	2.8	.3	− .3	− .1	.....
17	.....	.....	− .2	1.8	11.0	21.7	9.4	2.7	.3	− .3	− .1	.....
18	.....	.....	− .1	2.1	11.1	21.7	9.2	2.6	.2	− .2	− .1	.....
19	.....	.....	.0	2.7	11.2	21.7	9.0	2.5	.1	− .2	− .1	.....
20	.....	.....	.1	3.1	11.2	21.5	8.9	2.5	− .1	− .1	− .2	.....
21	.....	.....	.3	3.7	11.4	21.2	8.9	2.4	− .2	− .1	− .2	.....
22	.....	.....	.4	4.4	11.4	21.0	8.9	2.2	− .2	− .1	− .2	.....
23	.....	.....	.4	4.9	11.5	21.0	8.5	2.0	− .2	− .1	− .1	.....
24	.....	.....	.6	5.4	11.5	21.0	8.2	1.8	− .2	+ .1	− .1	.....
25	.....	.....	.5	6.0	11.5	20.5	7.9	1.7	− .3	.1	.0	.....
26	.....	.....	.6	6.5	11.6	20.0	7.4	1.7	− .3	.1	.0	.....
27	.....	.....	.7	6.8	11.7	19.5	7.1	1.5	− .3	.1	.0	.....
28	.....	.....	.7	7.2	11.8	19.0	7.0	1.4	− .4	.1	.1	.....
29	.....	.....	.7	7.4	11.9	18.5	7.0	1.2	− .4	.1	.0	.....
30	.....	.....	.7	7.6	12.0	18.0	6.9	1.1	− .5	.2	.0	.....
31	.....	.....	.8	.....	12.0	.....	6.7	1.1	.....	.2	.....	.....

Relation of gage heights of Clark Fork at Priest River, Idaho, and Newport, Wash.

Priest River gage height.	Newport gage height.	Priest River gage height.	Newport gage height.	Priest River gage height.	Newport gage height.	Priest River gage height.	Newport gage height.
Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
41.00	−3.55	46.00	2.95	51.00	9.15	56.00	15.00
42.00	−2.25	47.00	4.25	52.00	10.30	57.00	16.20
43.00	− .95	48.00	5.50	53.00	11.50	58.00	17.35
44.00	+ .35	49.00	6.75	54.00	12.65	59.00	18.55
45.00	1.65	50.00	7.95	55.00	13.85	60.00	19.70

NOTE.—The above table was obtained by plotting the daily readings at the two gages from May 1, 1904 to April 30, 1905, and is well defined between gage heights 42 feet and 57 feet, Priest River gage.

Rating table for Clark Fork at Newport, Wash., from 1904 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−2.00	6,700	0.40	12,880	2.80	21,510	7.40	42,840
−1.90	6,900	.50	13,190	2.90	21,920	7.60	43,880
−1.80	7,100	.60	13,500	3.00	22,330	7.80	44,940
−1.70	7,310	.70	13,810	3.20	23,150	8.00	46,000
−1.60	7,520	.80	14,130	3.40	23,990	8.20	47,080
−1.50	7,740	.90	14,450	3.60	24,830	8.40	48,160
−1.40	7,960	1.00	14,770	3.80	25,690	8.60	49,260
−1.30	8,190	1.10	15,100	4.00	26,550	8.80	50,360
−1.20	8,420	1.20	15,430	4.20	27,430	9.00	51,480
−1.10	8,660	1.30	15,770	4.40	28,310	10.00	57,200
−1.00	8,900	1.40	16,110	4.60	29,220	11.00	63,030
− .90	9,150	1.50	16,460	4.80	30,140	12.00	69,060
− .80	9,410	1.60	16,820	5.00	31,070	13.00	75,340
− .70	9,670	1.70	17,190	5.20	32,010	14.00	82,020
− .60	9,940	1.80	17,560	5.40	32,970	15.00	89,300
− .50	10,220	1.90	17,940	5.60	33,930	16.00	97,300
− .40	10,510	2.00	18,320	5.80	34,890	17.00	106,300
− .30	10,800	2.10	18,710	6.00	35,850	18.00	116,000
− .20	11,090	2.20	19,100	6.20	36,830	19.00	126,000
− .10	11,380	2.30	19,490	6.40	37,810	20.00	136,500
.00	11,670	2.40	19,890	6.60	38,790	21.00	147,000
.10	11,970	2.50	20,290	6.80	39,790	22.00	158,000
.20	12,270	2.60	20,690	7.00	40,790		
.30	12,570	2.70	21,100	7.20	41,810		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions above gage height −1.0 foot. Below this it is applicable to the partly ice-covered conditions that usually exist during the low-water periods in the winter. It is based on 11 discharge measurements made during 1903–1905 at Priest River and is well defined.

Monthly discharge of Clark Fork at Newport, Wash., for 1903 to 1908.

[Drainage area, 24,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1903.							
June 26–30	126,000	117,000	122,000	5.08	0.94	1,210,000	A.
July	114,000	44,800	73,900	3.08	3.55	4,570,000	A.
August	43,900	19,400	28,900	1.20	1.38	1,780,000	A.
September	19,000	14,300	15,800	.658	.73	940,000	A.
October	16,600	14,200	15,500	.646	.74	952,000	A.
November	18,100	15,400	16,100	.671	.75	957,000	A.
December	17,200	15,100	16,500	.688	.79	1,010,000	A.
The period	126,000	14,200	.....	.....	.....	11,400,000	
1904.							
January	14,800	11,900	13,200	.550	.63	812,000	A.
February	11,700	10,400	11,000	.458	.49	633,000	A.
March	15,400	10,800	13,500	.562	.65	830,000	A.
April	58,300	13,500	31,300	1.30	1.45	1,860,000	A.
May	92,000	60,000	74,500	3.10	3.57	4,580,000	A.
June	93,000	70,100	85,000	3.54	3.95	5,060,000	A.
July	68,700	32,200	49,800	2.08	2.40	3,060,000	A.
August	32,000	14,300	21,500	.896	1.03	1,320,000	A.
September	14,300	9,900	11,900	.496	.55	709,000	A.
October	9,740	8,510	9,060	.378	.44	557,000	A.
November	8,960	7,960	8,440	.352	.39	502,000	A.
December	8,510	7,830	8,180	.341	.39	503,000	A.
The year	93,000	7,830	28,100	1.17	15.94	20,400,000	

Monthly discharge of Clark Fork at Newport, Wash., for 1903 to 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.							
January	8,510	5,700	7,790	0.325	0.37	479,000	A.
February	8,370	5,860	7,320	.305	.32	406,000	A.
March	11,800	8,290	10,000	.417	.48	617,000	A.
April	17,100	11,400	12,700	.529	.59	756,000	A.
May	30,100	16,500	22,200	.925	1.07	1,360,000	A.
June	50,400	30,600	43,800	1.82	2.03	2,610,000	A.
July	42,300	19,900	30,600	1.28	1.48	1,880,000	A.
August	19,900	10,200	14,100	.588	.68	867,000	A.
September	10,200	7,960	8,840	.368	.41	526,000	A.
October	9,940	8,190	9,330	.389	.45	574,000	A.
November	9,670	9,150	9,470	.395	.44	564,000	A.
December	9,150	7,740	8,510	.355	.41	523,000	A.
The year	50,400	5,700	15,400	.641	8.73	11,200,000	
1906.							
January	7,960	7,100	7,500	.312	.36	461,000	A.
February	9,940	7,520	8,230	.343	.36	457,000	A.
March	10,500	6,700	9,210	.384	.44	566,000	B.
April	28,800	10,500	17,900	.746	.83	1,070,000	A.
May	40,800	29,200	36,600	1.52	1.75	2,250,000	A.
June	43,400	36,800	41,800	1.74	1.94	2,490,000	A.
July	36,800	19,500	29,000	1.21	1.40	1,780,000	A.
August	19,100	12,000	14,100	.588	.68	867,000	A.
September	12,000	8,900	10,200	.425	.47	607,000	A.
October	8,900	8,420	8,610	.359	.41	529,000	A.
November	22,700	8,420	15,700	.654	.73	934,000	A.
December	.....	.....	15,500	.646	.74	953,000	B.
The year	.....	.....	17,900	.744	10.11	13,000,000	
1907.							
January	.....	.....	12,800	.533	.61	787,000	B.
February	.....	.....	17,700	.738	.77	983,000	B.
March	19,500	15,400	17,400	.725	.84	1,070,000	A.
April	38,800	19,100	28,700	1.20	1.34	1,710,000	A.
May	86,300	37,800	57,900	2.41	2.78	3,560,000	A.
June	104,000	86,300	96,200	4.01	4.47	5,720,000	A.
July	95,700	47,600	75,800	3.16	3.64	4,660,000	A.
August	54,300	32,000	44,900	1.87	2.16	2,760,000	A.
September	30,600	15,800	22,600	.942	1.05	1,340,000	A.
October	15,800	9,150	11,300	.471	.54	695,000	A.
November	14,800	9,940	11,000	.458	.51	655,000	A.
December	.....	.....	11,200	.467	.54	689,000	B.
The year	.....	.....	34,000	1.42	19.25	24,600,000	
1908.							
January	.....	.....	9,210	.384	.44	566,000	B.
February	.....	.....	7,410	.309	.33	426,000	B.
March	14,100	9,150	11,500	.479	.55	707,000	A.
April	43,900	14,100	22,400	.933	1.04	1,330,000	A.
May	69,100	44,400	59,300	2.47	2.85	3,650,000	A.
June	155,000	69,700	121,000	5.04	5.62	7,200,000	A.
July	106,000	39,300	61,900	2.58	2.97	3,810,000	A.
August	38,300	15,100	23,700	.988	1.14	1,460,000	A.
September	15,100	10,200	12,500	.521	.58	744,000	A.
October	12,300	9,410	10,800	.450	.52	664,000	A.
November	12,300	11,100	11,800	.492	.55	702,000	A.
December	.....	.....	9,910	.413	.48	609,000	B.
The year	.....	.....	30,100	1.26	17.07	21,900,000	

NOTE.—Discharges for June 26, 1903, to April 30, 1905, are based on gage heights at Priest River; since May 1, 1905, on the records at Newport, except those for the winter months since December, 1906, which have been estimated on percentages of the discharge at The Dalles.

BITTERROOT RIVER [a] NEAR GRANTSDALE, MONT.

Bitterroot River rises in the high mountains that form the boundary line between Montana and Idaho, flows northward, and unites with Clark Fork a short distance below the city of Missoula. Its drainage area comprises about 1,550 square miles. Its tributaries are all small. Those from the east drain comparatively low hills and add little to the supply of the river, but the west side branches are numerous, drain precipitous and heavily wooded areas, and their discharge is regulated by many small lakes fed by banks of snow, remnants of which continue far into the summer. From Hamilton to Missoula, a distance of 48 miles, the fall of the river is 350 feet, or 7.3 feet to the mile.

The river affords a few possible power sites, but these will probably remain undeveloped for some time, as construction cost would be heavy. The water of the stream is extensively used for irrigation, and the valley is probably the best irrigated in the State. Logging is carried on to some extent on this river.

The gaging station was established April 25, 1902, to obtain information as to the quantity of water available for irrigation, and was discontinued December 31, 1907. It was located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton. Two large ditches, the New Hedge and the Republican, are taken out of the stream some distance above the station, and a large project to irrigate 50,000 acres is now nearing completion. The water is taken from Rock Creek, a small tributary rising in Lake Como.

The channel is straight above and below the station. The current has a medium velocity at moderate stages, but is extremely swift at high water. The bed of the stream is composed of bowlders and is shifting. The river is partly frozen over during a month or more in the winter. The datum of the standard chain gage remained unchanged. Estimates obtained are very good.

Discharge measurements of Bitterroot River near Grantsdale, Mont., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	J. E. Stewart	186	610	3.60	2,370
October 12	do	165	244	1.91	333

[a] Owing to a misinterpretation of the decision of the United States Geographic Board, this river was called Clark Fork in Water Supply Paper 214, Surface water supply of north Pacific coast drainage for 1906.

Daily gage height, in feet, of Bitterroot River near Grantsdale, Mont., for 1907.

[T. J. Holt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.8	2.25	2.5	3.2	6.4	5.8	3.2	2.15	1.95	1.95	1.95
2	2.2	2.75	2.2	2.55	3.25	6.5	5.6	3.15	2.25	1.95	1.95	1.95
3	2.05	2.55	2.2	2.55	3.3	7.0	5.5	3.1	2.25	1.9	1.95	1.9
4	2.1	2.5	2.15	2.55	3.35	7.25	5.4	3.0	2.35	1.9	1.9	1.9
5	2.2	2.55	2.2	2.75	3.4	7.0	5.3	3.0	2.35	1.85	1.9	1.9
6	2 15	2.5	2.1	2.75	3.4	6.75	5.25	2.9	2.4	1.85	1.9	1.9
7	2.15	2.55	2.15	2.8	3.45	6.5	5.15	2.8	2.4	1.85	1.95	1.9
8	2.0	2.5	2.1	2.8	3.75	6.0	5.1	2.7	2.45	1.8	1.95	1.9
9	2.05	2.55	2.15	2.85	4.5	5.75	5.0	2.6	2.35	1.8	1.95	1.85
10	2.05	2.5	2.1	2.95	5.0	5.5	4.9	2.5	2.4	1.85	1.9	1.85
11	2.15	2.55	2.1	3.55	5.2	5.4	4.7	2.5	2.3	1.85	1.85	1.85
12	2.15	2.5	2.05	3.8	5.4	5.25	4.6	2.45	2.35	1.9	1.85	1.8
13	2.2	2.55	2.1	3.85	5.5	5.25	4.35	2.4	2.25	1.95	1.85	1.8
14	4.0	2.5	2.0	4.05	5.6	5.0	4.25	2.3	2.3	1.95	1.8	1.8
15	3.55	2.55	2.05	4.25	5.7	5.0	4.2	2.3	2.2	1.9	1.8	1.8
16	3.55	2.4	2.05	4.35	5.75	4.9	4.2	2.2	2.25	1.9	1.8	1.8
17	3.55	2.45	2.1	4.25	5.8	4.9	4.2	2.2	2.15	1.95	1.85	1.85
18	3.5	2.4	2.1	4.05	5.9	4.75	4.15	2.15	2.15	1.95	1.85	1.85
19	3.55	2.45	2.15	3.55	6.0	4.6	4.1	2.15	2.05	2.0	1.85	1.9
20	2.75	2.35	2.4	3.45	6.1	4.65	4.05	2.1	2.1	2.0	1.9	1.9
21	2.8	2.4	2.55	3.4	6.3	5.75	4.0	2.1	2.0	1.95	1.9	1.9
22	2.75	2.3	2.75	3.45	6.5	5.5	4.0	2.0	2.0	1.95	1.95	1.9
23	2.8	2.35	2.8	3.45	6.4	5.6	3.95	2.05	1.95	1.95	1.95	1.95
24	2.75	2.35	2.7	3.4	6.0	5.65	3.9	1.95	1.95	1.9	1.95	1.95
25	2.8	2.45	2.7	3.35	5.0	5.7	3.8	2.0	1.9	1.9	1.9	1.95
26	2.75	2.35	2.6	3.3	4.6	5.7	3.6	1.95	1.9	1.9	1.9	1.95
27	2.8	2.35	2.55	3.25	4.7	5.75	3.5	1.95	1.95	1.95	1.9	1.9
28	2.75	2.3	2.5	3.25	5.0	5.75	3.4	1.85	2.0	1.95	1.9	1.9
29	2.8	.....	2.45	3.25	5.25	5.8	3.4	2.0	2.05	2.0	1.95	2.0
30	2.75	.....	2.4	3.2	5.75	5.8	3.3	2.05	2.2	2.0	1.95	2.05
31	2.8	.....	2.4	.....	6.3	.....	3.25	2.2	.....	2.0	.....	2.05

NOTE.—River gorged and ice conditions generally, January 14 to February 12; gage heights are to water surface.

Rating table for Bitterroot River near Grantsdale, Mont., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	280	2.90	1,330	4.00	3,130	5.20	5,810
1.90	350	3.00	1,455	4.10	3,330	5.40	6,330
2.00	430	3.10	1,590	4.20	3,530	5.60	6,850
2.10	510	3.20	1,730	4.30	3,740	5.80	7,390
2.20	595	3.30	1,880	4.40	3,950	6.00	7,950
2.30	685	3.40	2,040	4.50	4,160	6.20	8,530
2.40	780	3.50	2,210	4.60	4,380	6.40	9,130
2.50	880	3.60	2,380	4.70	4,600	6.60	9,740
2.60	985	3.70	2,560	4.80	4,830	6.80	10,370
2.70	1,095	3.80	2,740	4.90	5,070	7.00	11,020
2.80	1,210	3.90	2,930	5.00	5,310		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1907 and the form of previous curves and is well defined between gage heights 1.9 and 6.5 feet.

Monthly discharge of Bitterroot River near Grantsdale, Mont., for 1907.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January 1–13	685	430	[a] 541	0.349	0.40	33,300	C.
February 12–28	932	685	[a] 793	.512	.53	44,000	B.
March	1,210	430	694	.448	.52	42,700	A.
April	3,840	880	2,010	1.30	1.45	120,000	A.
May	9,430	1,730	5,610	3.62	4.17	345,000	A.
June	11,800	4,380	7,250	4.68	5.22	431,000	A.
July	7,390	1,800	4,040	2.61	3.01	248,000	A.
August	1,730	315	803	.518	.60	49,400	A.
September	830	350	583	.376	.42	34,700	B.
October	430	280	367	.237	.27	22,600	B.
November	390	280	351	.226	.25	20,900	B.
December	470	280	351	.226	.26	21,600	B.
The year	11,800	280	1,950	1.26	17.10	1,410,000	

[a] Means for January 1 to 13 and February 12 to 28 taken as means for the months.

FLATHEAD RIVER NEAR POLSON, MONT.

Flathead River rises on the western slope of the Continental Divide in the southeastern part of British Columbia and takes a general southerly course, passing through Flathead Lake to Dixon, Mont., where it turns abruptly and flows westward to its junction with Clark Fork, about 3 miles southeast of Paradise. It is a large stream with a number of important tributaries, chief among which may be mentioned the Middle and South forks, which rise in the Rocky Mountains, in the Lewis and Clark National Forest, flow northwestward, the Middle Fork uniting with the main stream about 6 miles southwest of Belton and the South Fork near Columbia Falls; Stillwater River, which enters near Kalispel; Swan River, which comes into Flathead Lake; Little Bitterroot River, which drains the northwestern part of the Flathead Indian Reservation; and Jocko River, which drains the southeastern part of the reservation. The valleys of the Middle and South forks and the main stream above Columbia Falls are very mountainous, but from Columbia Falls to the lake the valley is broad and fertile, and the stream is sluggish. Below the lake the river traverses the Flathead Indian Reservation, with its wide expanse of irrigable land. The river is not subject to sudden fluctuations in volume, as the lake serves to regulate its flow.

From August 23 to September 26, 1908, the lake level fell steadily from 2,881.1 feet to 2,880.2 feet, as determined by a gage at Polson.

The gaging station was established July 23, 1907, at Michels Ferry, 8 miles below Polson. In the vicinity of the station the river has a fall of 240 feet in 6 miles. In 1908 the mean discharge was 12,100

second-feet, and as it is possible to equalize the flow, an enormous amount of power can be developed. At the Newell dam site, located by the United States Reclamation Service, the stream flows from a narrow canyon whose bounding cliffs reach a great height. It is proposed to utilize the power for a pumping project to irrigate the lands of the Flathead Indian Reservation. There are no diversion canals taken from the river. The gage datum has not been changed since the station was first established, and estimates obtained at this station are excellent, as there is no appreciable change in the channel. Gaging conditions are little affected by ice and good winter records are obtained.

Discharge measurements of Flathead River near Polson, Mont., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 10	J. E. Stewart	455	4,020	6.97	15,200
September 9	do	445	3,230	5.35	8,880
October 15	do	424	2,670	3.92	5,550
1908.					
January 24 [a]	J. E. Stewart	395	1,740	1.48	2,340
April 17	Stewart and Richards	400	2.340	3.06	4,340
May 20 [b]	R. Richards	485	5,710	10.24	31,550
June 27 [b]	do	487	6,442	11.69	43,600
August 21	do	440	3,300	5.00	8,380
November 11	Richards and Huch	395	2,200	2.90	4,030

[a] A little shore ice.
[b] Observations could be made for only about 140 feet from each shore, as car touched the water in midstream.

Daily gage height, in feet, of Flathead River near Polson, Mont., for 1907.

[P. Michell, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.1	5.4	4.4	3.0	2.2	16		6.5	5.0	3.8	2.5	2.15
2		8.1	5.4	4.5	3.0	2.2	17		6.4	4.9	3.7	2.5	2.15
3		8.0	5.4	4.4	2.9	2.1	18		6.3	4.9	3.7	2.5	2.1
4		7.9	5.4	4.3	2.9	2.1	19		6.2	4.9	3.7	2.4	
5		7.8	5.4	4.3	2.9	2.1	20		6.1	4.8	3.6	2.4	
6		7.7	5.4	4.3	2.8	2.1	21		6.0	4.7	3.6	2.3	
7		7.5	5.3	4.2	2.8	2.1	22		5.85	4.7	3.6	2.3	
8		7.35	5.3	4.2	2.8	2.1	23	9.2	5.7	4.7	3.5	2.2	
9		7.15	5.3	4.2	2.8	2.1	24	9.1	5.7	4.7	3.5	2.3	
10		7.0	5.2	4.1	2.8	2.1	25	9.0	5.7	4.6	3.5	2.3	
11		6.9	5.2	4.1	2.8	2.15	26	8.9	5.6	4.6	3.4	2.4	
12		6.9	5.2	4.1	2.75	2.15	27	8.8	5.5	4.6	3.4	2.4	
13		6.8	5.1	4.0	2.75	2.15	28	8.7	5.5	4.6	3.4	2.3	
14		6.7	5.1	4.0	2.75	2.15	29	8.6	5.5	4.6	3.3	2.3	
15		6.6	5.1	3.9	2.6	2.15	30	8.4	5.5	4.6	3.3	2.2	
							31	8.3	5.4		3.0		

NOTE.—The river was below the gage December 19, 1907, to January 23, 1908, on which date a new low water gage was installed.

Daily gage height, in feet, of Flathead River near Polson, Mont., for 1908.

[P. Michell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	1.45	2.0	7.7	10.25	10.4	6.7	3.7	3.2	2.95	2.9
2	.....	1.3	1.45	2.0	7.8	10.3	10.4	6.6	3.6	3.2	2.95	2.8
3	.....	1.3	1.5	1.6	8.0	10.6	10.4	6.5	3.5	3.1	2.95	2.8
4	.....	1.3	1.45	1.6	8 2	10.6	10.3	6.3	3.4	3.0	2.95	2.75
5	.....	1.4	1.45	1.75	8.3	10.75	10.3	6.0	3.3	2.95	2.95	2.75
6	.....	1.5	1.3	1.75	8.45	10.9	10.3	6.9	3.2	2.8	3.0	2.75
7	.....	1.5	1.3	2.0	8.55	11.35	10.3	6.9	3.1	2.8	3.0	2.6
8	.....	1.5	1.3	1.9	8.9	12.5	10.2	6.7	4.0	2.9	3.0	2.6
9	.....	1.5	1.3	1.9	9.2	13.7	10.2	6.4	4.0	2.9	3.0	2.6
10	.....	1.5	1.3	1.9	9.5	14.1	10.2	6.2	3.5	2.9	3.0	2.6
11	.....	1.5	1.45	2.0	9.7	14.3	10.2	6.0	3.5	2.9	2.9	2.6
12	.....	1.5	1.45	2.0	10.0	14.6	10.1	5.9	3.5	2.9	2.9	2.6
13	.....	1.5	1.45	2.0	10.2	14.6	10.1	5.7	3.5	2.9	2.9	2.6
14	.....	1.5	1.45	2.3	10.2	14.6	10.1	5.6	3.5	2.9	2.9	2.6
15	.....	1.5	1.45	2.6	10.2	14.6	10.0	5.4	3.5	2.9	2.9	2.5
16	.....	1.5	1.45	2.9	10.3	14.55	9.9	5.3	3.75	2.9	2.9	2.5
17	.....	1.5	1.5	3.2	10.4	14.3	9.8	5.2	3.7	2.9	2.9	2.5
18	.....	1.5	1.5	3.5	10.4	13.9	9.7	5.1	3.65	2.9	2.9	2.4
19	.....	1.5	1.6	3.9	10.4	13.7	9.5	5.0	3.6	2.9	2.9	2.4
20	.....	1.5	1.6	4.3	10.25	13.4	9.3	5.0	3.6	2.9	2.9	2.4
21	.....	1.5	1.6	4.9	10.2	13.45	8.7	5.1	3.65	2.9	2.9	2.3
22	.....	1.5	1.6	5.6	10.1	13.1	8.6	4.55	3.5	3.0	2.9	2.3
23	1.5	1.5	1.5	5.9	10.0	12.9	8.0	4.55	3.5	3.0	2.9	2.3
24	1.5	1.5	1.5	6.3	10.0	12.6	8.0	4.3	3.5	3.0	2.9	2.25
25	1.5	1.5	1.5	6.8	9.95	12.35	7.9	4.2	3.45	3.0	2.9	2.25
26	1.5	1.5	1.6	7.0	9.95	12.4	7.6	4.1	3.45	3.0	2.9	2.25
27	1.5	1.5	1.6	7.4	10.0	11.7	7.5	4.0	3.45	3.0	2.9	2.2
28	1.5	1.45	1.8	7.5	10.1	11.7	7.4	3.9	3.3	2.95	2.9	2.2
29	1.4	1.45	1.8	7.6	10.1	11.6	7.3	3.9	3.25	2.95	2.9	2.2
30	1.4	.....	1.9	7.65	10.1	11.4	6.9	3.7	3.2	2.95	2.9	2.2
31	1.4	.....	2.0	.....	10.2	.....	6.8	3.8	.....	2.95	.....	2.2

Rating table for Flathead River near Polson, Mont., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	2,280	2.80	3,880	4.30	6,380	6.60	13,660
1.40	2,360	2.90	4,020	4.40	6,610	6.80	14,490
1.50	2,440	3.00	4,160	4.50	6,850	7.00	15,360
1.60	2,530	3.10	4,300	4.60	7,090	7.20	16,270
1.70	2,620	3.20	4,450	4.70	7,340	7.40	17,220
1.80	2,710	3.30	4,600	4.80	7,600	7.60	18,190
1.90	2,810	3.40	4,750	4.90	7,870	7.80	19,180
2.00	2,910	3.50	4,910	5.00	8,150	8.00	20,200
2.10	3,020	3.60	5,070	5.20	8,720	9.00	25,520
2.20	3,130	3.70	5,230	5.40	9,330	10.00	31,200
2.30	3,250	3.80	5,400	5.60	9,970	11.00	37,230
2.40	3,370	3.90	5,570	5.80	10,640	12.00	43,630
2.50	3,490	4.00	5,750	6.00	11,350	13.00	50,530
2.60	3,620	4.10	5,950	6.20	12,080	14.00	57,700
2.70	3,750	4.20	6,160	6.40	12,850	15.00	65,000

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1907–8, and is well defined below gage height 9.0 feet and fairly well above.

Monthly discharge of Flathead River near Polson, Mont., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
July 23–31	26,600	21,800	24,300	434,000	A.
August	20,700	9,330	13,900	855,000	A.
September	9,330	7,090	8,290	493,000	A.
October	6,850	4,160	5,520	339,000	A.
November	4,160	3,130	3,620	215,000	A.
December[a]	3,130	2,810	3,000	184,000	A.
The period				2,520,000	
1908.					
January[a]	2,810	2,360	2,450	156,000	B.
February	2,440	2,280	2,420	139,000	A.
March	2,910	2,280	2,460	151,000	A.
April	18,400	2,530	7,040	419,000	A.
May	33,600	18,700	29,000	1,780,000	A.
June	62,100	32,700	48,800	2,900,000	B.
July	33,600	14,500	27,100	1,670,000	A.
August	14,900	5,230	9,570	588,000	A.
September	5,750	4,300	4,940	294,000	A.
October	4,450	3,880	4,090	251,000	A.
November	4,160	4,020	4,060	242,000	A.
December	4,020	3,130	3,480	214,000	A.
The year	62,100	2,280	12,100	8,800,000	

[a] Discharges interpolated December 19, 1907, to January 22, 1908.

STILLWATER RIVER NEAR KALISPEL, MONT.

Stillwater River rises in the northern part of Flathead County and flows southeastward through several lakes into Flathead River.

The gaging station, which was established September 25, 1906, and discontinued May 31, 1907, was located at the Reiter wagon bridge 2 miles from Kalispel. The flow is controlled by dams above. The measuring section is below the mouth of Whitefish River and includes the flow of that stream. The intake of the city waterworks is between the mouth of Whitefish and the gage. Owing to the extreme sluggishness of the Stillwater above the mouth of the Whitefish, it is impossible to make measurements; hence the flow of the Stillwater is obtained by subtracting the flow at the Whitefish station from that at this station. This gives the amount available for irrigation.

Daily gage height, in feet, of Stillwater River near Kalispel, Mont., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	1.55	1.58	2.0	1.9	3.55	16	1.45	1.6	1.7	3.05	5.7
2	1.52	1.5	2.0	1.9	3.58	17	1.42	1.7	1.68	3.15	6.75
3	1.6	1.5	1.95	2.0	3.5	18	1.42	1.7	1.7	2.95	6.95
4	1.6	1.5	1.95	2.0	3.4	19	1.48	1.7	1.7	3.2	6.85
5	1.58	1.55	1.95	2.1	3.52	20	1.5	1.7	1.78	3.28	7.2
6	1.5	1.55	2.0	2.1	3.5	21	1.5	1.7	1.9	3.42	7.25
7	1.5	1.58	1.95	2.1	3.7	22	1.55	1.8	1.88	3.45	6.8
8	1.4	1.6	1.8	2.3	3.55	23	1.55	1.85	1.8	3.45	6.3
9	1.4	1.65	1.75	2.75	3.8	24	1.58	2.0	1.78	3.35	5.9
10	1.4	1.65	1.8	2.6	4.15	25	1.55	2.0	1.88	3.3	5.55
11	1.45	1.5	1.8	2.65	4.7	26	1.55	2.0	1.78	3.2	5.12
12	1.5	1.45	1.75	2.7	4.9	27	1.55	2.05	1.82	3.2	4.9
13	1.5	1.4	1.7	2.7	4.85	28	1.55	2.0	1.8	3.2	4.78
14	1.5	1.5	1.7	2.8	4.95	29	1.6	.....	1.92	3.25	4.85
15	1.45	1.52	1.7	2.85	5.1	30	1.6	.....	1.85	3.5	5.15
						31	1.65	.....	1.85	.....	5.65

LITTLE BITTERROOT CREEK NEAR DAYTON, MONT.

Little Bitterroot Creek rises in Little Bitterroot Lake, near Marion, Mont., flows in a general southeasterly direction, and unites with Flathead River 12 miles north of Dixon. It is about 50 miles long, has numerous small tributaries, and drains an area of about 600 square miles. Several reservoir sites have been surveyed in the upper part of the stream, about 15 miles above the gaging station. Near Hubbart the stream has a sheer fall of about 50 feet and is bounded by high cliffs.

The gaging station was established April 18, 1908, near Dayton, at McDonald's ranch, 12 miles north of the Warm Springs, on the Flathead Indian Reservation, and the results will be used by the United States Reclamation Service to determine the amount of water available for irrigating portions of Little Bitterroot Valley. Above the station a few small tributaries add to the volume of the creek and several ditches take water from it. The water is not all appropriated.

The datum of the gage has not changed since it was established. The channel is not likely to shift. This river freezes over in winter.

Discharge measurements of Little Bitterroot Creek near Dayton, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
April 18	Stewart and Richards	35	58.7	6.10	133
May 21	R. Richards	29	64.7	5.97	133
June 28	do	23	53.1	5.50	85.6
August 22 [a]	do	23	20.6	4.34	20.8
November 10 [a]	Huch and Richards	26	28.9	4.41	11.5

[a] Measured by wading.

Daily gage height, in feet, of Little Bitterroot Creek near Dayton, Mont., for 1908.

[A. P. McDonald, observer.]

Day.	Apr.	May.	June.	Sept.	Oct.	Nov.	Dec.	Day.	Apr.	May.	June.	Sept.	Oct.	Nov.	Dec.
1		5.65			4.4	4.45	4.32	16		6.0		4.2	4.6	4.35	([a])
2		5.65			4.35	4.45	4.3	17		6.0		4.25	4.5	4.35	
3		5.95			4.4	4.4	4.3	18	6.05	6.0		4.2	4.4	4.4	
4		6.2			4.4	4.4	4.38	19	6.3	6.0		4.6	4.4	4.5	
5		6.1			4.35	4.4	4.3	20	6.5	6.0		4.35	4.4	4.45	
6		5.9			4.3	4.4	4.3	21	7.0	6.0		4.3	4.4	4.5	
7		5.95		4.3	4.3	4.45	4.3	22	6.95	([b])		4.3	4.4	4.45	
8		6.2		4.35	4.3	4.4	4.3	23	7.0			4.25	4.5	4.4	
9		6.3		4.2	4.3	4.4	4.4	24	7.2			4.35	4.45	4.4	
10		6.2		4.2	4.3	4.4	4.35	25	6.8			4.35	4.42	4.4	
11		6.1		4.2	4.3	4.4	4.3	26	6.45			4.35	4.4	4.4	
12		6.1		4.2	4.4	4.45	4.32	27	6.2			4.4	4.4	4.4	
13		6.1		4.15	4.45	4.4	4.32	28	5.9		5.5	4.45	4.4	4.4	
14		6.0		4.1	4.5	4.45	4.3	29	5.8			4.4	4.4	4.4	
15		6.2		4.15	4.7	4.35	4.3	30	5.7			4.35	4.4	4.42	
								31					4.4		

[a] River frozen entirely across December 16 to 31.
[b] No record from May 22 to September 6; the maximum stage, as estimated from high-water marks, was 7.85 feet, and occurred probably about June 2.

Rating table for Little Bitterroot Creek near Dayton, Mont., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	13	5.10	58	6.10	138	7.10	250
4.20	16	5.20	64	6.20	148	7.20	262
4.30	19	5.30	71	6.30	158	7.30	274
4.40	23	5 40	78	6.40	169	7.40	286
4.50	27	5.50	85	6.50	180	7.50	298
4.60	31	5.60	93	6.60	191	7.60	311
4.70	36	5.70	101	6.70	202	7.70	324
4.80	41	5.80	110	6.80	214	7.80	337
4.90	46	5.90	119	6.90	226	7.90	350
5.00	52	6.00	128	7.00	238		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 4 discharge measurements made during 1908 and is fairly well defined below gage height 6.5 feet.

Monthly discharge of Little Bitterroot Creek near Dayton, Mont., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
April 18-30	262	101	177	4,550	B.
May	158	97	134	8,240	B.
June	344	82	124	7,380	C.
July	80	46	61.3	3,770	C.
August	44	21	29.5	1,810	C.
September	31	13	19.3	1,150	B.
October	36	19	23.3	1,430	B.
The period				28,300	

NOTE.—There is no record from May 21 to September 6. During this period the estimate has been based on the high-water mark, and two subsequent gage heights, in addition to a comparison with the discharge of neighboring streams.

CROW CREEK NEAR RONAN, MONT.

Crow Creek rises in the eastern part of the Flathead Indian Reservation and flows in a generally southwesterly direction, entering Flathead River about 3 miles below the mouth of the Little Bitterroot.

The gaging station which was established September 21, 1906, for the purpose of obtaining data for use in connection with a project to irrigate the Flathead Indian Reservation, is located about 4 miles south of Ronan at the highway bridge on the stage road from St. Ignatius to Ronan. Investigations in connection with this project have been carried on by the United States Reclamation Service since the summer of 1907.

No important tributaries enter the creek above the station and no water is diverted. Mud and Spring creeks empty into Crow Creek several miles below. The current is very sluggish and during the winter months the discharge is affected by ice. The gage datum has not been changed since the station was established.

This station affords good conditions for obtaining accurate discharge data, as the channel does not change appreciably except during flood stages.

Discharge measurements of Crow Creek near Ronan, Mont., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 2 [a]	J. E. Stewart	30	30.4	1.22	35.3
May 24	Robert Follansbee	42	135	3.34	173
June 7	do	49	216	5.08	353
July 24	J. E. Stewart	38	99	2.81	126
August 9 [a]	do	30	50	1.90	67
September 10 [a]	do	30	30.2	1.39	42.6
October 14 [a]	do	27	19.9	1.09	25.3
1908.					
April 16 [a]	Stewart and Richards	36	56.8	1.96	68.3
May 19 [a]	R. Richards	27	60.8	3.03	146
June 29 [a]	do	39	103	3.50	151
July 19 [a]	J. E. Stewart	38	87.6	3.03	121
August 24 [a]	R. Richards	27	17.0	1.34	33.5
October 6	do	33	19.2	[b] .95	22.5
November 12 [c]	Richards and Huch	37	49.2	[d] 1.61	19.6

[a] Measured by wading.
[b] Observer's gage reading.
[c] Creek full of ice.
[d] Gage height probably affected by ice conditions.

Daily gage height, in feet, of Crow Creek near Ronan, Mont., for 1907 and 1908.

[A. McIntyre, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.35	.....	1.40	1.40	1.20	4.80	4.65	2.25	.....	1.20	.....	0.88
2	1.25	.....	1.30	1.40	1.25	5.35	4.30	2.20	1.70	1.20	0.98	.88
3	1.20	.....	1.30	1.70	1.30	5.05	4.75	2.18	1.60	1.22	.92	.88
4	1.25	.....	1.10	1.60	1.30	4.65	5.40	2.12	1.50	1.20	.92	.88
5	1.35	.....	1.35	1.40	1.30	4.60	5.12	2.18	1.50	1.15	.90	.88
6	.....	0.80	1.10	1.45	1.20	4.95	4.62	2.05	1.50	1.10	.90	.88
7	.....	.....	1.10	1.30	1.35	4.95	4.30	1.98	1.50	1.10	.90	.88
8	.....	.....	1.25	1.25	1.50	5.68	4.10	1.90	1.40	1.10	.90	.88
9	1.30	.....	1.10	1.12	1.95	5.10	4.10	1.85	1.40	1.10	.90	.88
10	.....	.....	.....	1.35	2.45	4.55	4.20	1.90	1.40	1.10	.90	.88
11	.....	.....	1.18	1.38	2.98	4.18	4.00	1.80	1.38	1.10	.90	.88
12	.....	.....	1.15	1.30	2.85	4.28	3.92	1.80	1.45	1.10	.90	.88
13	.....	.....	1.10	1.30	2.58	4.85	4.00	1.80	1.45	1.10	.90	.88
14	.....	.....	.....	1.60	2.35	4.55	4.05	1.78	1.38	1.10	.90	.88
15	.....	.80	1.10	1.72	2.60	4.18	3.70	1.70	1.35	1.05	.90	.88
16	1.30	.....	1.10	1.78	3.45	4.28	3.25	1.68	1.35	1.05	.90	.86
17	.....	.....	1.00	1.72	4.45	4.28	3.32	1.68	1.35	1.05	.90	.85
18	.....	.....	1.00	1.55	4.80	4.12	3.20	1.62	1.30	1.02	.90	.85
19	.....	.....	1.30	1.48	4.88	.....	3.05	1.60	1.30	1.00	.90	.80
20	.....	.....	1.80	1.40	5.35	.....	2.92	1.58	1.30	1.00	.90	.....
21	.....	.....	2.70	1.30	4.95	4.60	3.00	1.52	1.30	1.00	.90	.85
22	.....	.....	2.00	1.35	4.38	4.70	3.02	1.52	1.30	1.00	.90	.90
23	1.40	.....	1.80	1.45	3.88	4.80	2.88	1.45	1.30	1.00	.90	.90
24	.....	.....	1.70	1.55	3.42	4.55	2.65	1.50	1.25	1.00	.90	.90
25	.....	.....	1.55	1.40	3.00	4.15	2.75	.....	1.22	1.00	.90	.....
26	.....	1.25	1.35	1.40	2.45	4.40	2.60	1.70	1.20	1.00	.90	.85
27	.....	1.85	1.30	1.40	2.35	4.80	2.50	1.70	1.22	1.00	.90	.90
28	.....	1.60	1.30	1.35	2.80	4.92	2.45	1.78	1.25	.98	.88	.90
29	.....	.....	1.20	1.30	3.15	5.00	2.40	1.80	1.20	.98	.88	.90
30	.....	.....	1.20	1.25	3.50	5.20	2.40	1.80	1.20	.98	.88	.....
31	.....	.....	.....	.....	4.00	.....	2.32	1.78	.....	.98	.....	.....

Daily gage height, in feet, of Crow Creek near Ronan, Mont., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	.....	.....	0.90	0.80	1.65	4.55	3.90	1.80	1.20	0.95	1.40	.....
2	.....	.....	.90	.80	2.25	6.10	3.80	1.80	1.20	.95	1.40	.....
3	.....	.....	.85	.80	3.05	5.40	3.90	1.70	1.05	.95	1.40	.....
4	.....	.....	.95	.80	2.95	5.80	3.95	1.70	1.00	.95	1.40	.....
5	.....	.....	.95	.80	2.85	6.0	3.80	1.70	1.00	.95	1.40	.....
6	.....	.....	.95	.80	3.00	.....	3.50	1.60	1.00	.95	1.40	.....
7	.....	.....	.80	.80	3.65	.....	3.15	1.60	1.00	.95	1.35	.....
8	.....	.....	.80	.80	4.75	.....	2.85	1.50	1.30	.95	1.35	.....
9	.....	.....	.80	.80	4.70	.....	2.75	1.50	1.25	.95	1.35	.....
10	.....	.....	.80	.80	3.95	.....	2.60	1.45	1.05	.95	1.30	.....
11	.....	.....	.80	.80	3.75	.....	2.45	1.50	1.00	.98	1.30	.....
12	.....	.....	.80	1.20	3.60	.....	2.45	1.50	1.00	1.08	1.45	.....
13	.....	.....	.90	1.25	3.75	.....	2.50	1.50	1.00	1.40	1.20	.....
14	.....	.....	1.00	1.50	3.55	.....	2.40	1.50	1.00	1.75	1.20	.....
15	.....	.....	1.02	1.55	3.65	.....	2.35	1.40	1.00	1.55	1.20	.....
16	.....	.....	1.00	1.85	3.85	.....	3.00	1.40	1.00	1.40	1.10	.....
17	.....	.....	1.05	1.95	3.85	.....	4.95	1.40	1.20	1.40	1.10	.....
18	.....	.....	1.02	1.80	3.45	.....	3.20	1.40	1.45	1.30	1.10	.....
19	.....	.....	1.00	.....	3.10	.....	2.80	1.40	4.50	1.30	1.20	.....
20	.....	.....	1.05	2.20	2.85	.....	2.45	1.40	2.65	1.35	1.20	.....
21	.....	.....	1.00	2.40	2.20	.....	2.60	1.40	2.00	1.40	1.20	.....
22	.....	.....	.90	2.60	2.10	.....	2.50	1.40	1.70	1.40	1.20	.....
23	.....	.....	.85	2.80	2.30	.....	2.40	1.40	1.55	1.35	1.20	.....
24	.....	.....	.90	3.10	2.60	.....	2.35	1.40	1.45	1.32	1.05	.....
25	.....	.....	.90	2.90	3.05	.....	2.25	1.40	1.40	1.30	1.05	.....
26	.....	.....	.90	2.90	4.10	.....	2.20	1.30	1.30	1.30	1.00	.....
27	.....	.....	.90	1.90	3.95	.....	2.10	1.30	1.20	1.30	1.00	.....
28	.....	.....	.85	1.80	3.85	.....	2.15	1.30	1.20	1.30	1.00	.....
29	.....	.....	.80	1.65	4.05	3.50	2.10	1.30	1.05	1.35	1.00	.....
30	.....	.....	.80	1.55	4.00	3.70	2.05	1.32	1.00	1.35	1.00	.....
31	.....	.....	.80	.....	.....	.....	1.88	1.30	.....	1.35	.....	.....

NOTE.—Creek frozen entirely across, January 7 to February 25, 1907. Average ice thickness, 12 inches. Ice conditions at gage March 5, 1907. Partial ice conditions during December, 1907. The gage was washed out by exceptionally high water, June 6, 1908; the maximum stage was estimated from high-water marks as 10.85 feet and occurred probably on either June 5 or 6, 1908.

Rating table for Crow Creek near Ronan, Mont., for January 1, 1907, to June 5, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	18	1.90	68	3.00	142	4.20	252
.90	21	2.00	74	3.10	150	4.40	274
1.00	25	2.10	80	3.20	158	4.60	296
1.10	29	2.20	86	3.30	166	4.80	320
1.20	33	2.30	92	3.40	175	5.00	344
1.30	37	2.40	98	3.50	184	5.20	368
1.40	42	2.50	105	3.60	193	5.40	392
1.50	47	2.60	112	3.70	202	5.60	417
1.60	52	2.70	119	3.80	212	5.80	443
1.70	57	2.80	126	3.90	222	6.00	469
1.80	62	2.90	134	4.00	232	6.20	495

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1907–8, and is fairly well defined.

Monthly discharge of Crow Creek near Ronan, Mont., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January [a]			25.0	1,540	D.
February [a]			20.0	1,110	D.
March	119	25	39.8	2,450	B.
April	61	30	43.7	2,600	B.
May	386	33	148	9,100	B.
June	427	244	306	18,200	B.
July	392	93	196	12,100	B.
August	89	44	62.8	3,860	B.
September	59	33	41.1	2,450	B.
October	34	24	27.5	1,690	B.
November	24	20	21.2	1,260	B.
December	21	18	20.0	1,230	C.
The year			79.3	57,600	
1908.					
March	27	18	21.5	1,320	B.
April	150	18	57.0	3,390	B.
May	314	54	179	11,000	B.
June [b]	1,400	151	536	31,900	D.
July	250	55	109	6,700	B.
August	52	32	37.5	2,310	B.
September	271	22	42.0	2,500	C.
October	59	23	34.0	2,090	C.
November	39	20	24.2	1,440	C.
The period				62,600	

[a] Estimated. [b] Discharges interpolated June 6 to 28.

NOTE.—From June 29, 1908, to November 30, 1908, the discharge was obtained by the indirect method for shifting channels.

MUD CREEK NEAR RONAN, MONT.

Mud Creek, a small tributary of Crow Creek, rises about 6 miles southeast of Flathead Lake and flows southwestward.

The gaging station, which was established April 17, 1908, to obtain data for irrigation, is located 3 miles northwest of Ronan. The United States Reclamation Service will probably use the water on the Flathead project. The Pablo ditch, the only one of importance, diverts water from the creek a few miles above the station. No changes have been made in the gage, as the current is very sluggish and it is difficult to obtain accurate results.

Discharge measurements of Mud Creek near Ronan, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	J. E. Stewart	5.5	4.3	2.14	4.4
May 20	R. Richards	10	11.3	2.54	9.2
June 27	do	11.5	43.7	4.40	39.9
July 20	Hoyt and Stewart	10.5	32.6	3.59	23.6
August 21	R. Richards	5.5	12.2	3.10	9.8
November 11	Richards and Huch	5.5	11.4	2.90	6.2

Daily gage height, in feet, of Mud Creek near Ronan, Mont., for 1908.

[F. O. Geffrey, observer.]

Day.	Apr.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Apr.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.2	3.0	3.0	3.0	2.85	17	2.15	3.1	2.6	3.05	2.9	2.95
2	.....	3.3	3.0	3.0	3.0	2.9	18	2.15	3.1	2.55	3.05	2.9	2.8
3	.....	3.3	2.5	3.0	3.0	2.8	19	2.25	3.05	2.5	3.05	3.0	2.8
4	.....	3.3	2.5	3.0	3.0	2.95	20	2.25	3.05	2.7	3.0	3.0	.....
5	.....	3.35	2.45	3.0	3.0	2.8	21	2.25	3.05	3.0	3.0	3.0	.....
6	.....	3.25	2.45	3.05	3.0	2.95	22	2.25	3.0	3.0	3.0	3.0	.....
7	.....	3.1	2.4	3.05	3.0	2.9	23	2.25	3.05	3.1	3.0	3.0	.....
8	.....	3.15	2.4	3.05	3.0	2.9	24	2.3	3.05	3.05	3.0	2.9	.....
9	.....	3.1	2.4	3.0	2.95	2.9	25	2.25	3.05	3.0	3.0	2.95	.....
10	.....	3.1	2.35	3.0	2.95	2.9	26	2.3	3.1	3.0	3.0	2.9	.....
11	.....	3.1	2.35	3.0	2.9	2.9	27	2.3	3.05	3.0	3.0	2.95	.....
12	.....	3.15	2.4	3.0	2.95	2.9	28	2.3	3.0	3.0	3.0	2.9	.....
13	.....	3.25	2.5	3.0	2.9	2.95	29	2.3	3.0	3.0	3.0	3.0	.....
14	.....	3.2	2.5	3.0	2.9	2.9	30	2.35	3.05	3.0	3.0	3.0	.....
15	.....	3.2	2.5	3.0	2.95	2.9	31	.....	3.0	.....	3.0	.....	.....
16	.....	3.15	2.55	3.0	2.9	2.95							

NOTE.—Gage heights for May to July are believed to be very much in error and are not published.

Rating table for Mud Creek near Ronan, Mont., from August 1 to December 20, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	2.5	2.60	4.0	2.90	7.0	3.20	11
2.40	3.0	2.70	5.0	3.00	8.0	3.30	13
2.50	3.5	2.80	6.0	3.10	9.0	3.40	15

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based upon 2 discharge measurements made during 1908, and is fairly well defined above gage height 2.8 feet.

Monthly discharge of Mud Creek near Ronan, Mont., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
April 17-30 [a]	7	5	6.29	175	C.
August	14	8	9.77	601	C.
September	9	2.8	5.30	315	C.
October	8.5	8	8.10	498	C.
November	8	7	7.60	452	C.
December 1-19	7.5	6	6.89	260	C.

[a] Discharge for April estimated from a measurement made April 17.

MISSION CREEK NEAR ST. IGNATIUS, MONT.

Mission Creek rises in the western slope of the Mission Range and flows in a general northwesterly direction into Flathead River about 3 miles above Dixon. Its only important tributary, Dry Creek, enters it just above St. Ignatius.

The gaging station which is located opposite the home of A. A. Booke, about 1 mile downstream from St. Ignatius, was established September 21, 1906, to obtain data for use in connection with water power and irrigation projects. Two or three small ditches, which are used to irrigate about 800 acres near St. Ignatius Mission, divert water above the gage.

A few miles above the station where the stream flows out from mountains it has a fall of nearly 1,000 feet and affords an excellent opportunity for water-power development.

The gage was washed out July 5, 1907, and on July 24 a new gage was installed a short distance downstream and with a datum 0.30 foot lower; on January 25, 1908, this gage was lowered 0.39 foot. The gage was again destroyed by high water June 7, 1908, and was replaced June 26, 20 feet farther downstream at a different datum.

The current is swift and the records of flow are but little affected by ice during the winter months. The channel shifts during high water, but at ordinary stages the conditions for obtaining accurate discharge data are good.

Discharge measurements of Mission Creek near St. Ignatius, Mont., in 1907 and 1908.

[Miss A. Annie Booke, observer.]

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 2	J. E. Stewart	24	21.6	0.61	33.8
May 24	Robert Follonsbee	31	33.4	1.09	109
June 7	do	34	56	1.70	267
July 24	J. E. Stewart	45	74	1.52	197
August 9	do	28	36.4	1.08	125
September 10	do	26	28.3	.72	78
October 14	do	26	19.0	.38	41.8
1908.					
January 25	J. E. Stewart	11	8.0	.24	9.6
April 16	Stewart and Richards	12	8.7	.46	18.0
May 19	R. Richards	28	29.8	1.19	85.4
July 19	J. E. Stewart	32	56.8	3.36	211
August 24	R. Richards	25	35.1	2.89	69.6
October 6	do	24.5	27.1	2.81	46.6
November 7	Huch and Richards	23.5	26.4	2.80	38.8

NOTE.—Measurements in 1908 were made by wading. Gage datum was lowered 0.30 foot July 24, 1907, and 0.39 foot January 25, 1908. After June, 1908, a new gage was used, having no relation to previous gages.

Daily gage height, in feet, of Mission Creek near St. Ignatius, Mont., for 1907 and 1908.

[Miss A. Annie Booke, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.55	0.30	.....	0.52	0.65	1.90	2.20	1.30	.....	0.45	0.25	.....
2	.55	.30	0.40	.55	.65	2.00	1.90	1.30	0.80	.45	.25	0.05
3	.55	.....	.....	.60	.65	1.50	1.95	1.30	.80	.45	.25	.05
4	.55	.30	.40	.60	.65	1.30	2.40	.....	.80	.45	.25	.05
5	.55	.30	.35	.60	.65	1.40	(a)	1.25	.78	.45	.20	.05
6	.55	.30	.35	.55	.65	1.50	.....	1.15	.80	.45	.20	.05
7	.50	.30	.35	.....	.65	1.60	.....	1.00	.70	.45	.20	.05
8	(b)	.30	.35	.52	.70	1.65	.....	1.00	.....	.45	.20	.....
9	.....	.....	.35	.50	.80	1.50	.....	1.00	.80	.42	.20	.05
10	.....	.30	.....	.53	.90	1.30	.....	1.00	.75	.40	.....	.05
11	.....	.30	.40	.51	1.00	1.45	.....	1.00	.80	.38	.20	.05
12	.....	.30	.35	.51	.....	1.50	.....	.98	.80	.35	.20	.05
13	.....	.30	.35	.53	.90	1.50	.....	.92	.72	.....	.20	.05
14	.....	.30	.35	.60	.90	1.30	.....	.90	.70	.35	.15	.05
15	.....	.30	.35	.62	.90	1.50	.....	.90	.....	.30	.10	.....

[a] The gage was washed out July 5, 1907; a new gage was installed July 24 a short distance downstream, and with a datum 0.30 foot lower.

[b] Creek frozen to the bottom at the gage, January 8 to 20, 1907.

Daily gage height, in feet, of Mission Creek near St. Ignatius, Mont., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	.....	0.30	0.35	0.70	1.20	1.50	.....	0.88	.....	0.30	0.10	0.02
17	.....	.....	.....	.70	1.30	1.50	.....	.80	0.60	.30	.....	.02
18	.....	.....	.35	.68	1.40	1.50	.....	.....	.60	.30	.10	.00
19	.....	.30	.40	.65	1.60	1.50	.....	.80	.60	.30	.10	.00
20	.....	.30	.48	.62	1.60	1.50	.....	.80	.55	.30	.10	.00
21	0.40	.30	.58	.60	1.45	1.50	.....	.75	.55	.30	.10	(a)
22	.40	.30	.55	.60	1.25	1.50	.....	.75	.....	.30	.10	.....
23	.38	.40	.50	.60	1.20	1.50	.....	.72	.60	.30	.05	.....
24	.35	.....	.....	.75	1.10	1.50	1.50	.70	.60	.30	.....	.....
25	.30	.42	.50	.62	1.02	1.40	1.45	.80	.52	.30	.05	.....
26	.30	.40	.45	.62	1.00	1.60	1.40	.80	.50	.30	.05	.....
27	.....	.40	.45	.....	1.00	1.80	1.35	.90	.50	.....	.05	.....
28	.35	.40	.45	.65	1.10	2.05	.....	.85	.50	.30	.05	.....
29	.....	.....	.40	.65	1.15	2.20	1.30	.80	.50	.28	.05	.....
30	.40	.....	.40	.65	1.22	2.10	1.30	.85	.48	.25	.05	.....
31	.30	.....	.....	.....	1.35	.....	1.30	.80	.....	.25	.....	.....
1908.												
1	.....	.20	.25	.25	.90	2.20	3.90	3.00	2.80	2.80	.....	2.75
2	.....	.20	.25	.25	1.15	2.10	3.80	3.00	2.80	2.85	2.80	2.75
3	.....	.20	.25	.25	1.50	2.05	3.70	3.00	2.80	2.80	2.80	2.75
4	.....	.20	.25	.25	1.70	2.15	.....	3.00	2.80	.....	2.80	2.75
5	.....	.25	.25	.25	1.60	4.30	.....	3.00	2.80	2.80	2.80	2.75
6	.....	.25	.25	.25	1.70	7.28	3.52	3.00	2.80	2.80	2.80	2.75
7	.....	.25	.25	.25	2.15	(b)	3.38	3.00	2.85	2.80	2.80	2.75
8	.....	.25	.25	.25	2.10	.....	3.40	3.00	2.82	2.80	.....	2.75
9	.....	.....	.20	.25	1.90	.....	3.35	.....	2.80	2.80	2.80	2.75
10	.....	.25	.20	.25	1.50	6.90	3.50	2.95	2.80	2.80	2.80	2.75
11	.....	.25	.20	.25	1.50	.....	3.40	2.95	2.80	.....	2.80	2.75
12	.....	.25	.20	.....	1.25	.....	3.40	2.95	2.80	2.85	2.80	2.75
13	.....	.25	.25	.32	1.22	.....	3.40	2.90	.....	2.80	2.80	.....
14	.....	.25	.25	.38	1.28	.....	3.50	2.90	2.80	2.85	2.80	2.75
15	.....	.25	.25	.45	.....	.....	3.40	2.90	2.80	2.85	2.80	2.74
16	.....	.....	.30	.55	1.30	.....	3.55	.....	2.85	2.85	2.80	.....
17	.....	.20	.30	.55	1.30	.....	3.70	2.90	2.88	2.85	2.80	2.70
18	.....	.20	.30	.58	1.28	.....	3.50	2.90	3.00	.....	2.78	2.70
19	.....	.20	.30	.....	1.20	.....	3.50	2.90	3.10	2.85	2.80	2.70
20	.....	.20	.30	.80	1.20	.....	3.35	2.90	3.05	2.80	2.80	2.70
21	.....	.20	.30	.95	1.25	.....	.....	2.90	3.00	2.80	2.80	2.70
22	.....	.20	.30	1.15	1.25	.....	3.25	2.90	3.00	2.85	.....	2.70
23	.....	.20	.25	1.20	1.25	.....	3.30	2.90	2.95	2.85	2.78	2.70
24	.....	.20	.25	1.15	1.25	.....	3.25	2.90	2.90	2.80	2.75	2.70
25	c .25	.20	.25	1.00	1.30	.....	3.20	2.90	2.90	2.80	2.75	.....
26	.25	.22	.25	.90	1.50	3.40	3.20	2.90	2.90	2.80	2.75	2.70
27	.25	.25	.25	.85	1.50	3.60	3.20	2.88	.....	2.80	2.75	.....
28	.25	.25	.25	.70	1.40	3.50	3.20	2.88	2.80	2.80	2.75	2.70
29	.25	.25	.....	.70	1.40	3.70	3.10	2.88	2.80	2.80	.....	2.70
30	.20	.....	.25	.80	1.50	3.80	3.00	2.85	2.80	2.80	2.75	2.70
31	.20	.....	.25	.....	.....	.....	3.00	2.85	.....	2.80	.....	2.70

a Water was below the gage December 21, 1907, to January 24, 1908.

b The gage was destroyed by high water June 7, 1908. On June 26 a new gage was installed 20 feet farther downstream at a different datum. The gage height of June 10 was determined by high water marks and is referred to the new datum.

c The gage was lowered 0.39 foot January 25, 1908.

Rating tables for Mission Creek near St. Ignatius, Mont.

JANUARY 1 TO JULY 4, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	13	0.90	75	1.50	207	2.00	369
.40	19	1.00	92	1.60	236	2.10	405
.50	27	1.10	110	1.70	267	2.20	442
.60	36	1.20	131	1.80	300	2.30	480
.70	47	1.30	154	1.90	334	2.40	519
.80	60	1.40	180				

a This table is not applicable for ice or obstructed-channel conditions. It is based upon 5 discharge measurements made during 1906–7, and is well defined between gage heights 0.5 foot and 1.8 feet.

Rating tables for Mission Creek near St. Ignatius, Mont.—Continued.

JULY 24 TO DECEMBER 31, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	11	0.40	43	0.80	87	1.20	144
.10	18	.50	53	.90	100	1.30	160
.20	26	.60	64	1.00	114	1.40	177
.30	34	.70	75	1.10	129	1.50	195

JANUARY 25 TO JUNE 6, 1908.[b]

0.20	8	1.60	142	3.00	400	4.80	786
.30	11	1.70	158	3.10	421	5.00	830
.40	15	1.80	174	3.20	442	5.20	874
.50	20	1.90	191	3.30	463	5.40	918
.60	26	2.00	209	3.40	484	5.60	962
.70	34	2.10	227	3.50	505	5.80	1,006
.80	43	2.20	245	3.60	526	6.00	1,050
.90	53	2.30	263	3.70	547	6.20	1,096
1.00	63	2.40	282	3.80	568	6.40	1,142
1.10	74	2.50	301	3.90	589	6.60	1,188
1.20	86	2.60	320	4.00	610	6.80	1,234
1.30	99	2.70	340	4.20	654	7.00	1,280
1.40	113	2.80	360	4.40	698	7.20	1,326
1.50	127	2.90	380	4.60	742	7.40	1,372

JUNE 26 TO DECEMBER 31, 1908.[c]

2.70	25	3.10	120	3.50	265	3.90	440
2.80	44	3.20	151	3.60	307	4.00	487
2.90	66	3.30	186	3.70	350		
3.00	92	3.40	224	3.80	394		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907, after July 24, and is well defined between gage heights 0.4 foot and 1.5 feet.
[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908, and is well defined between gage heights 0.2 foot and 1.5 feet.
[c] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908, and is well defined between gage heights 2.7 feet and 3.5 feet.

Monthly discharge of Mission Creek near St. Ignatius, Mont., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January[a]	32	10	16.9	1,040	C.
February	21	13	14.4	800	B.
March	34	16	20.2	1,240	B.
April	54	27	36.7	2,180	B.
May	236	41	103	6,330	B.
June	442	154	236	14,000	A.
July[b]	550	160	293	18,000	B.
August	160	75	107	6,580	A.
September	87	51	70.9	4,220	A.
October	48	36	38.5	2,370	A.
November	30	14	21.1	1,260	C.
December	14	10	11.8	726	D.
The year	550	10	80.8	58,700	

[a] Discharge estimated at 10 second-feet, January 8 to 20.
[b] Discharges for July 5 to 23 were estimated with the aid of a hydrograph.

Monthly discharge of Mission Creek near St. Ignatius, Mont., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January [a]	10	8	9.87	607	B.
February	10	8	9.03	519	B.
March	11	8	9.97	613	A.
April	86	10	29.7	1,770	A.
May	236	53	120	7,380	A.
June [b]	2,000	218	823	49,000	D.
July	440	92	230	14,100	A.
August	92	55	73.5	4,520	A.
September	120	44	58.6	3,490	A.
October	55	44	47.7	2,930	A.
November	44	34	41.3	2,460	C.
December	34	25	29.5	1,810	C.
The year	2,000	8	124	89,200	

[a] Discharge estimated January 1 to 24. [b] Discharges estimated June 7 to 25.

DRY CREEK NEAR ST. IGNATIUS, MONT.

Dry Creek rises on the western slopes of the Mission Range in the southeastern part of the Flathead Reservation and flows northwestward.

The gaging station, which was established April 16, 1908, to obtain data for use in connection with a project to irrigate land in Mission Creek valley, is located opposite Felman's ranch, about 3½ miles southeast of St. Ignatius. The creek is the outlet of St. Marys Lake, which will be used as a reservoir to store the entire flow of the stream.

The current is swift. The bed of the stream is composed of coarse gravel and bowlders, and some of the water—1 or 2 second-feet—sinks into the ground and is lost before it reaches the gage. At low and medium stages none of the water reaches Mission Creek, and during the winter and early spring it ceases to flow at the gage. Above the station one small ditch diverts water for irrigation. The only tributary is a small creek which enters from the right a short distance below the station. The conditions are fair for obtaining accurate discharge data.

Discharge measurements of Dry Creek near St. Ignatius, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	J. E. Stewart	7	6.4	1.15	6.9
May 19	R. Richards	13	9.7	1.90	27.3
June 26	do	15	21.9	1.30	73.1
July 19	Hoyt and Stewart	15	17.2	1.10	43.6
August 24	R. Richards	9	4.2	.25	5.4
October 6	do	7.2	3.2	.08	2.6
November 7	Richards and Huch	8	4.14	[a] 1.25	4.1

[a] Gage height probably wrong.

NOTE.—Measurements were made by wading.

Daily gage height, in feet, of Dry Creek near St. Ignatius, Mont., for 1908.

[Henry Felsman, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.3	2.4	1.2	0.8	0.15	0.3	0.2
2	.....	1.4	2.6	1.0	.7	(a)	.3	.2
3	.....	1.6	2.5	1.1	.7	.....	.3	.35
4	.....	1.7	2.6	1.0	.8	.....	.25	.4
5	.....	1.6	4.0	1.3	.7	.....	.23	.7
6	.....	1.7	(b)	1.4	.6	.....	.1	.7
7	.....	1.9	(b)	1.8	.6	.....	.1	.6
8	.....	2.2	3.0	1.3	.6	.1	.1	.6
9	.....	2.2	3.0	1.4	.6	.15	.1	.7
10	.....	2.1	3.0	1.4	.5	.15	.1	.65
11	.....	2.0	3.0	1.4	.5	.1	.1	.6
12	.....	1.9	2.9	1.4	.5	.1	.25	.5
13	.....	1.9	2.9	1.4	.5	.1	.2	.5
14	.....	1.9	2.9	1.4	.4	.1	.2	.5
15	.....	1.9	2.8	1.4	.4	.1	.3	.5
16	1.15	2.0	2.9	1.6	.4	.15	.45	.55
17	1.15	2.0	2.8	1.4	.3	.18	.5	.4
18	1.2	1.9	2.7	1.3	.3	.7	.5	.5
19	1.2	1.9	1.4	1.4	.3	.7	.45	.5
20	1.3	1.8	1.7	1.3	.3	.8	.4	.55
21	1.35	1.9	1.2	1.3	.3	.8	.3	.5
22	1.4	1.8	1.0	1.4	.3	.75	.3	.5
23	1.6	1.8	.9	1.3	.3	.78	.3	.5
24	1.7	1.8	.9	1.2	.3	.6	.3	.4
25	1.6	1.8	.9	1.0	.3	.6	.3	.45
26	1.5	1.9	1.2	1.0	.25	.5	.3	.4
27	1.45	1.9	1.2	.9	.2	.45	.3	.3
28	1.4	2.0	1.2	.9	.2	.4	.25	.3
29	1.4	2.0	1.0	1.2	.2	.3	.25	.2
30	1.3	2.2	1.1	.9	.1	.3	.2	(c)
31	.....	2.4	.....	.8	.15	.....	.2	.....

a Water below the gage. b Water over the gage. c Creek dry.

Rating table for Dry Creek near St. Ignatius, Mont., April 16 to June 7, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	6	1.90	27	2.70	63	3.50	109
1.20	8	2.00	31	2.80	68	3.60	116
1.30	10	2.10	35	2.90	73	3.70	123
1.40	12	2.20	39	3.00	79	3.80	130
1.50	15	2.30	43	3.10	85	3.90	137
1.60	18	2.40	48	3.20	91	4.00	144
1.70	21	2.50	53	3.30	97		
1.80	24	2.60	58	3.40	103		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based upon 2 discharge measurements made during 1908 and is not well defined.

Monthly discharge of Dry Creek near St. Ignatius, Mont., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
April 16–30	21	7	12.2	363	C.
May	48	10	27.3	1,680	C.
June	250	48	119	7,080	D.
July	92	28	54.7	3,360	C.
August	28	3	11.5	707	C.
September	17	1	6.93	412	D.
October	7	3	5.16	317	D.
November	5	0	3.13	186	D.
The period	.....	.....	.....	14,100	

NOTE.—Discharges were obtained by the indirect method for shifting channels June 8 to November 30; June 6 and 7 estimated.

POST CREEK NEAR ST. IGNATIUS, MONT.

Post Creek rises on the western slope of the Mission Range and flows southwestward to Mission Creek. It is the outlet of Lake McDonald, and it is possible to equalize the flow of the stream throughout the year by storage in the lake.

The gaging station, which was established September 21, 1906, to obtain data for use in connection with irrigation and power projects, is located at the home of Joseph Allard, about 10 miles north of St. Ignatius, Mont.

Two small ditches divert water above the gage to irrigate a few acres. The North Fork, the only important tributary, enters 2 or 3 miles below the gage.

The current is swift and the records of flow are but little affected by ice during the winter months. The channel is permanent and the conditions for obtaining accurate discharge data are good. The gage datum has remained unchanged.

Discharge measurements of Post Creek near St. Ignatius, Mont., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 2	J. E. Stewart	20	21.2	1.37	44.0
May 24	Robert Follansbee	26	36.8	2.14	139
June 7	do	31	64	2.80	290
July 24	J. E. Stewart	27	50	2.55	236
August 9	do	26	34.8	2.06	128
September 10	do	24	28	1.76	78.0
October 14	do	20	18.4	1.38	36.2
1908.					
January 25[a]	J. E. Stewart	18	15.6	1.16	20.4
April 16	Stewart and Richards	20	21.2	1.42	52.1
May 19	R. Richards	26	37.1	1.88	112
July 19[a]	J. E. Stewart	33.5	48.2	2.01	138
August 24[a]	R. Richards	29	25.0	1.36	47.7
October 6[a]	do	22	18.3	1.10	31.1
November 9[a]	Huch and Richards	22	17.8	1.10	29.7
Do.[b]	R. Richards	14	15.7	1.10	12.7

[a] Measured by wading.
[b] Measurement of a small channel which was opened up during the flood in June and was not discovered until November 9.

Daily gage height, in feet, of Post Creek near St. Ignatius, Mont., for 1907 and 1908.

[Joseph Allard, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	1.30	1.30	1.30	1.40	3.00	3.05	2.40	1.90	1.40	1.30	1.25
2	.....	[a] 2.00	1.30	1.30	1.40	.....	2.85	2.40	1.85	1.40	1.30	1.25
3	.....	[a] 1.60	1.30	1.35	1.40	2.82	2.70	2.40	1.75	1.40	1.30	1.25
4	.....	1.30	1.30	1.40	1.30	2.70	.....	2.40	1.70	1.40	1.30	1.25
5	.....	1.30	1.30	1.40	1.30	2.80	.....	2.40	1.70	1.40	1.30	1.25
6	.....	1.30	1.20	1.40	1.30	2.88	.....	2.30	1.70	1.40	1.30	1.25
7	.....	1.30	1.20	1.35	1.35	2.80	.....	2.30	1.70	1.40	1.30	1.25
8	.....	1.30	1.20	1.30	1.40	2.70	2.70	2.20	1.70	1.40	1.30	1.25
9	.....	1.30	1.20	1.30	1.50	2.60	2.70	2.20	1.70	1.38	1.30	1.25
10	.....	1.30	1.20	1.30	1.55	2.50	2.70	2.10	1.70	1.35	1.30	1.25
11	.....	1.30	1.20	1.35	1.60	2.50	2.70	2.10	1.70	1.35	1.30	1.25
12	.....	1.45	1.20	1.40	1.70	2.50	2.70	2.05	1.65	1.35	1.25	1.25
13	.....	.....	1.20	1.40	1.60	2.45	2.68	2.00	1.60	1.35	1.25	1.25
14	.....	.....	1.20	1.45	1.60	2.40	2.62	1.95	1.55	1.35	1.25	1.25
15	.....	.....	1.20	1.50	1.50	2.30	2.60	1.90	1.50	1.35	1.25	1.25
16	.....	.....	1.20	1.50	1.65	2.20	2.60	1.85	1.50	1.30	1.25	1.25
17	.....	.....	1.20	1.50	1.85	2.25	2.70	1.80	1.50	1.30	1.25	1.25
18	.....	.....	1.20	1.50	2.10	2.30	2.60	1.80	1.50	1.30	1.22	1.25
19	.....	.....	1.20	1.55	2.40	2.45	2.60	1.80	1.50	1.30	1.20	1.25
20	.....	.....	1.30	1.55	2.50	2.60	2.50	1.70	1.45	1.30	1.20	1.20
21	.....	.....	1.30	1.50	2.40	2.75	2.50	1.70	1.40	1.30	1.20	1.20
22	.....	.....	1.30	1.50	2.30	2.70	2.50	1.65	1.40	1.30	1.20	1.20
23	.....	.....	1.30	1.45	2.20	2.70	2.50	1.60	1.40	1.30	1.25	1.20
24	.....	.....	1.30	1.40	2.08	2.60	2.50	1.60	1.40	1.30	1.25	1.20
25	.....	.....	1.30	1.40	1.92	2.60	2.50	1.65	1.40	1.30	1.25	1.20
26	.....	.....	1.30	1.40	2.00	2.65	2.50	1.80	1.40	1.30	1.25	1.20
27	.....	.....	1.30	1.40	2.10	2.85	2.45	1.80	1.45	1.30	1.25	1.20
28	.....	.....	1.30	1.40	2.20	2.90	2.40	1.80	1.50	1.30	1.25	1.20
29	.....	.....	1.30	1.40	2.32	3.10	2.40	1.80	1.40	1.30	1.25	1.20
30	.....	.....	1.30	1.40	2.42	3.20	2.40	1.80	1.40	1.30	.....	1.20
31	.....	.....	1.30	.....	2.78	.....	2.40	1.80	.....	1.30	.....	1.20
1908.												
1	.....	1.15	1.10	1.10	1.60	2.28	2.10	.....	1.20	1.20	1.05	
2	.....	1.15	1.10	1.10	1.70	2.60	2.35	1.70	1.10	1.15	1.05	1.05
3	.....	1.15	1.10	1.15	1.70	2.55	2.40	1.60	1.10	1.12	1.05	1.05
4	.....	1.15	1.10	1.15	1.60	2.62	2.30	1.60	1.10	1.10	1.05	1.05
5	1.20	1.15	1.10	1.15	1.70	4.22	2.30	1.52	1.10	1.10	1.05	1.05
												1.06
6	1.20	1.15	1.10	1.15	1.80	([b])	2.22	1.50	1.10	1.08	1.05	
7	1.20	1.15	1.10	1.15	1.88	.....	2.25	1.45	1.18	1.05	1.05	1.05
8	1.20	1.15	1.10	1.15	2.05	.....	2.25	1.40	1.32	1.00	1.05	1.05
9	1.20	1.15	1.10	1.15	2.20	.....	2.32	1.40	1.30	1.00	1.05	1.05
10	1.20	1.15	1.10	1.15	2.05	.....	2.45	1.40	1.30	1.00	1.05	1.05
												1.05
11	1.20	1.15	1.10	1.15	1.90	.....	2.35	1.40	1.25	1.00	1.05	
12	1.20	1.15	1.10	1.20	1.88	.....	2.28	1.35	1.20	1.00	1.05	1.05
13	1.20	1.15	1.10	1.22	1.85	.....	2.30	1.40	1.25	1.00	1.05	1.05
14	1.20	1.15	1.10	1.25	1.90	.....	2.30	1.40	1.25	1.00	1.05	1.00
15	1.20	1.15	1.20	1.30	1.95	.....	2.40	1.38	1.25	1.00	1.05	1.00
												.95
16	1.20	1.15	1.20	1.35	2.05	.....	2.40	1.35	1.32	1.00	1.05	
17	1.15	1.15	1.20	1.45	1.95	.....	2.30	1.35	1.50	1.00	1.05	.92
18	1.15	1.15	1.20	1.50	1.98	.....	2.20	1.40	1.58	1.00	1.05	.90
19	1.15	1.15	1.20	.....	1.92	.....	2.05	1.40	1.70	1.00	1.05	.90
20	1.15	1.15	1.20	1.55	1.80	.....	.....	1.40	1.60	1.00	1.05	.95
												.95
21	1.15	1.15	1.20	1.62	1.80	.....	.....	1.35	1.50	1.00	1.05	
22	1.15	1.15	1.20	1.65	1.85	.....	.....	1.35	1.50	1.00	1.05	1.00
23	1.15	1.15	1.20	1.65	1.80	.....	.....	1.35	1.40	1.00	1.05	1.00
24	1.15	1.15	1.20	1.72	1.85	.....	.....	1.35	1.40	1.00	1.05	1.00
25	1.15	1.15	1.20	1.82	1.95	.....	.....	1.35	1.35	1.00	1.05	.....
26	1.15	1.15	1.15	1.78	2.15	2.44	.....	1.32	1.32	1.00	1.05	1.00
27	1.15	1.15	1.15	1.70	2.12	.....	.....	1.30	1.30	1.05	1.05	1.00
28	1.15	1.15	1.15	1.62	2.20	2.00	.....	1.25	1.30	1.05	1.05	1.00
29	1.15	1.10	1.15	1.60	2.12	1.98	.....	1.25	1.25	1.08	1.05	1.00
30	1.15	.....	1.15	1.60	2.15	1.92	.....	1.20	1.20	1.10	1.05	1.00
31	1.15	.....	1.15	.....	2.10	.....	.....	1.20	.....	1.05	.....	1.00

[a] Creek raised by ice jam.

[b] The gage was destroyed June 6 by high water and replaced June 26 at the same datum. The maximum stage as estimated from high-water marks was 8.48 feet, and probably occurred about June 10.

Rating tables for Post Creek near St. Ignatius, Mont.

JANUARY 1 TO AUGUST 13, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	35	1.90	99	2.60	244
1.30	39	2.00	116	2.70	269
1.40	44	2.10	134	2.80	295
1.50	51	2.20	153	2.90	322
1.60	60	2.30	174	3.00	350
1.70	71	2.40	196	3.10	380
1.80	84	2.50	220	3.20	412

AUGUST 14 TO DECEMBER 31, 1907.[b]

1.20	25	1.50	47	1.80	84
1.30	31	1.60	58	1.90	99
1.40	38	1.70	70	2.00	116

APRIL 1, 1908, TO DECEMBER 31, 1908.[c]

0.90	22	2.10	156	3.30	464
1.00	25	2.20	178	3.40	493
1.10	29	2.30	201	3.50	522
1.20	35	2.40	225	3.60	552
1.30	42	2.50	250	3.70	582
1.40	50	2.60	275	3.80	612
1.50	60	2.70	301	3.90	643
1.60	72	2.80	327	4.00	674
1.70	85	2.90	354	4.20	738
1.80	100	3.00	381	4.40	803
1.90	117	3.10	408	4.60	869
2.00	136	3.20	436		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 6 discharge measurements made during 1907 and is well defined above gage height 1.7 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based upon 1 discharge measurement made after the high-water period and also the form of the previous curve.

[c] This table is not applicable for ice or obstructed-channel conditions. It is based upon 6 discharge measurements made during 1908 and the form of the 1907 curve, and is well defined between gage heights 1.0 foot and 3.0 feet.

Monthly discharge of Post Creek near St. Ignatius, Mont., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	.....	.....	[a] 40.0	2,460	C.
February	.....	.....	[a] 40.0	2,220	C.
March	39	35	37.2	2,290	B.
April	56	39	45.4	2,700	B.
May	290	39	106	6,520	B.
June	412	153	261	15,500	A.
July[b]	410	196	259	15,900	B.
August	196	58	116	7,130	B.
September	99	38	55.7	3,310	B.
October	38	31	33.7	2,070	B.
November	31	25	28.6	1,700	B.
December	28	25	26.8	1,650	B.
The year	.....	.....	87.4	61,400	

[a] Estimated. [b] Discharges for July 4 to 7, 1907, estimated by the aid of a hydrograph.

Monthly discharge of Post Creek near St. Ignatius, Mont., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	25	20	22.6	1,390	B.
February	30	22	25.1	1,440	C.
March	35	27	30.7	1,890	C.
April	103	29	53.7	3,200	B.
May	178	72	123	7,560	A.
June	2,200	121	832	49,500	D.
July	238	90	166	10,200	B.
August	85	35	51.3	3,150	A.
September	85	29	44.2	2,630	A.
October	35	25	26.5	1,630	A.
November	27	27	27.0	1,610	A.
December	27	22	25.4	1,560	A.
The year	2,200	20	119	85,800	

JOCKO RIVER NEAR JOCKO, MONT.

Jocko River rises in the eastern part of the Flathead Indian Reservation and flows in a general northwesterly direction into Flathead River near Dixon.

The station, which was established August 20, 1908, to obtain data for irrigation, is located near the highway bridge on the road between Jocko and Ravalli about 1¼ miles northwest of the Jocko Agency. The Reclamation Service is now irrigating the Jocko Valley. Big Knife and Blodgett creeks enter the Jocko River above the gage, and Finley, Agency, and Valley creeks enter below the station. A few small ditches divert water from Jocko River between its source and Ravalli, and the waters of its tributaries are used to some extent for irrigation near the Jocko Agency. Indian Ditch, diverted from the East Finley, is the largest ditch now in operation. Five thousand acres are to be irrigated in the upper Jocko Valley.

Measurements are made by wading at low water and from the highway bridge in flood season. The channel is not likely to shift in ordinary stages.

Although the waters of this stream are being used for irrigation, its power possibilities could be developed. The river carries a good supply of water at a rapid fall and in many places is bounded by high cliffs.

Discharge measurements of Jocko River near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	C. E. Hewitt		532	[a] 12.25	6,200
August 20 [b]	R. Richards	50	65.7	7.32	141
October 7 [b]	do	48.5	54.3	7.12	95.7
November 6 [b]	Richards and Huch	48.5	53.8	7.20	121

[a] Gage height obtained from high-water marks. Discharge estimated from floats.
[b] Measured by wading.

Daily gage height, in feet, of Jocko River near Jocko, Mont., for 1908.

[C. E. Hewitt, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1					16				
2					17				
3					18				
4					19			7.11	
5					20	7.32			
6				7.20	21				
7			7.12		22	7.30			
8					23		7.28		
9					24	7.29			
10					25	7.30	7.26	7.14	
11					26	7.25			
12		7.15			27	7.27			
13					28				
14					29	7.26			
15					30				
					31				

JOCKO RIVER AT RAVALLI, MONT.

This gaging station is located about 400 feet downstream from a point opposite the railroad station at Ravalli. It was established October 18, 1906, to obtain data for use in connection with irrigation and power development.

Several small ditches divert water above the gage for irrigation. The total diversion probably does not exceed 1 per cent of the discharge of the stream.

The current is swift and the flow is but little affected by ice during the winter months. The channel shifts during very high water, but is permanent at ordinary stages. The conditions for obtaining accurate discharge data are good. The gage datum has remained unchanged.

Discharge measurements of Jocko River at Ravalli, Mont., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 18	Follansbee and Richards	46	80	1.69	150
November 20 [a]	R. Richards	67	120	2.14	317
1907.					
May 3	J. E. Stewart	45	104	2.28	382
May 25	Robert Follansbee	50	181	3.60	887
June 8	do	50	283	4.50	1,900
July 22	J. E. Stewart	46	122	2.75	509
August 9	do	45	92	2.32	334
September 10	do	45	84	2.02	232
1908.					
January 23 [a]	J. E. Stewart			1.37	94
April 20	Stewart and Richards	46	108	2.30	323
May 22	R. Richards	50	129	2.90	520
June 25	do	52	172	4.64	825
July 19	Hoyt and Stewart	52	134	3.60	459
August 20	R. Richards	46	101	2.74	261
October 7	do	41	99.7	2.48	222
November 6 [a]	Richards and Huch	57	80.8	2.52	194

[a] Measured by wading.

Daily gage height, in feet, of Jocko River at Ravalli, Mont., for 1907 and 1908.

[J. W. Covington and George Pendray, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	1.8	1.75	1.9	2.05	2.3	3.9	3.55	2.45	2.15	2.0	1.8	1.7
2	1.8	1.75	1.9	2.05	2.25	3.9	3.6	2.4	2.15	2.0	1.8	1.7
3	1.75	1.75	1.85	2.15	2.25	3.9	3.9	2.4	2.1	2.0	1.8	1.7
4	1.75	1.75	1.85	2.15	2.25	4.1	3.6	2.35	2.1	2.0	1.8	1.7
5	1.75	1.8	1.85	2.2	2.25	4.3	3.4	2.35	2.1	2.0	1.8	1.7
6	1.7	1.8	1.85	2.2	2.25	.....	3.25	2.35	2.1	2.0	1.8	1.7
7	1.7	1.9	1.85	2.0	2.3	.....	3.15	2.3	2.1	2.0	1.8	1.7
8	1.7	2.0	1.85	2.1	2.45	4.5	3.15	2.3	2.05	2.0	1.8	1.7
9	1.7	1.9	1.85	2.15	2.75	.....	3.15	2.3	2.05	2.0	1.8	1.7
10	1.7	1.8	1.85	2.15	3.0	.....	3.1	2.35	2.05	1.9	1.8	1.7
11	1.7	1.8	1.85	2.15	3.3	3.7	3.05	2.35	2.0	1.9	1.8	1.7
12	1.7	1.8	1.85	2.3	3.2	3.95	3.0	2.3	2.0	1.9	1.8	1.7
13	1.65	1.75	1.85	2.3	3.1	3.75	2.95	2.3	2.1	1.9	1.8	1.7
14	1.65	1.75	1.85	2.4	3.2	3.7	2.9	2.3	2.05	1.9	1.8	1.7
15	1.65	1.75	1.9	2.6	3.25	3.7	2.85	2.3	2.0	1.9	1.8	1.7
16	1.65	1.75	1.9	2.7	3.6	3.6	2.8	2.25	2.0	1.9	1.8	1.7
17	1.65	1.75	2.0	2.7	.....	3.4	2.8	2.25	2.0	1.9	1.8	1.7
18	1.65	1.8	2.2	2.6	4.1	3.4	2.75	2.2	2.0	1.9	1.8	1.7
19	1.65	1.85	2.3	2.5	4.1	3.5	2.7	2.2	2.0	1.9	1.8	1.7
20	1.7	1.9	2.3	2.3	.....	3.6	2.65	2.2	2.0	1.9	1.8	1.7
21	1.7	1.9	2.3	2.35	.....	3.7	2.7	2.15	.....	1.9	1.7	1.7
22	1.75	1.9	2.3	2.3	.....	3.8	2.75	2.15	2.0	1.8	1.7	1.7
23	1.75	1.9	2.3	2.5	3.75	3.95	2.6	2.15	2.0	1.8	1.7	1.7
24	1.75	2.0	2.3	2.5	3.65	3.7	2.6	2.15	2.0	1.8	1.7	1.7
25	1.75	2.3	2.25	2.45	3.6	3.6	2.55	2.1	2.1	1.8	1.7	1.6
26	1.75	2.05	2.2	2.5	3.5	3.8	2.55	2.1	2.0	1.8	1.7	1.6
27	1.75	2.0	2.2	2.6	3.4	3.8	2.5	2.15	2.0	1.8	1.7	1.6
28	1.75	1.95	2.15	2.6	3.6	3.8	2.5	2.25	2.0	1.8	1.7	1.6
29	1.75	.....	2.15	2.5	3.9	3.8	2.5	2.25	2.0	1.8	1.7	1.6
30	1.75	.....	2.1	2.4	3.9	3.7	2.45	2.2	2.0	1.8	1.7	1.6
31	1.75	.....	2.1	.....	3.9	.....	2.4	2.2	.....	1.8	.....	1.6
1908.												
1	1.6	1.6	1.3	1.5	2.3	3.6	4.3	3.0	2.8	2.5	2.5	.....
2	1.6	2.0	1.3	1.5	2.6	(b)	4.3	3.0	2.8	2.5	2.5	.....
3	1.6	2.8	1.3	1.5	2.3	.....	4.2	3.0	2.7	2.5	2.5	.....
4	1.6	2.0	1.3	1.5	2.8	.....	4.2	3.0	2.7	2.5	2.5	.....
5	1.6	2.0	1.3	1.5	2.7	.....	4.1	3.0	2.7	2.6	2.5	.....
6	1.5	1.4	1.3	1.5	2.9	.....	4.0	3.0	2.7	2.6	2.5	.....
7	1.5	1.5	1.3	1.5	3.3	.....	3.9	3.0	2.7	2.6	2.5	.....
8	1.5	1.4	1.3	1.5	3.3	.....	3.8	3.0	2.7	2.6	2.5	.....
9	1.5	1.4	1.3	1.5	3.3	.....	3.8	3.0	2.7	2.6	2.5	.....
10	1.5	1.4	1.3	1.5	3.3	.....	3.7	3.1	2.7	2.6	2.5	.....
11	1.5	1.4	1.3	1.5	2.7	.....	3.7	3.1	2.7	2.5	2.5	.....
12	1.5	1.4	1.4	1.5	2.7	.....	3.6	3.1	2.7	2.5	2.5	.....
13	1.5	1.4	1.4	1.6	2.7	.....	3.6	3.1	2.7	2.6	2.4	.....
14	1.5	1.4	1.5	1.6	2.7	.....	3.6	3.0	2.7	2.6	2.4	.....
15	1.5	1.4	1.5	1.8	2.8	.....	3.6	3.0	2.7	2.6	2.4	.....
16	1.5	1.4	1.6	1.8	3.0	.....	3.9	3.0	2.7	2.6	2.4	.....
17	1.5	1.4	1.6	2.0	2.8	.....	3.9	3.0	2.85	2.7	2.4	.....
18	1.5	1.4	1.6	2.0	2.8	.....	3.8	3.0	3.0	2.7	2.4	.....
19	1.5	1.3	1.6	2.0	2.8	.....	3.6	3.0	3.35	2.6	2.4	.....
20	1.5	1.3	1.5	2.3	2.7	.....	3.5	2.9	3.5	2.6	2.4	.....
21	1.5	1.3	1.5	2.5	2.7	.....	3.4	2.9	3.4	2.6	2.4	.....
22	1.5	1.3	1.5	2.7	2.9	.....	3.4	2.9	3.3	2.5	2.4	.....
23	1.5	1.3	1.5	3.0	2.8	.....	3.4	2.9	3.25	2.5	2.4	.....
24	1.5	1.3	1.5	2.8	2.8	.....	3.3	2.9	3.2	2.5	2.4	2.2
25	1.5	1.3	1.5	2.6	3.1	4.6	3.3	2.9	3.15	2.5	2.4	.....
26	1.5	1.3	1.5	2.5	3.0	4.8	3.3	2.9	3.0	2.5	2.4	.....
27	1.4	1.3	1.5	2.3	2.9	4.6	3.3	2.9	2.9	2.5	2.4	.....
28	1.4	1.3	1.5	2.2	3.1	4.5	3.2	2.9	2.85	2.5	2.4	.....
29	1.4	1.3	1.5	2.1	2.8	4.4	3.1	2.9	2.75	2.5	2.4	.....
30	1.4	.....	1.5	2.2	3.0	4.4	3.1	2.9	2.6	2.5	2.4	.....
31	1.5	.....	1.5	.....	3.2	.....	3.1	2.9	.....	2.5	.....	.....

[a] Gage heights for May 30 to July 21 are uncertain, as the gage settled about June 1 and was not corrected until July 21. No ice at this station.

[b] The gage was washed out June 2 by high water and was replaced June 25 at the same datum. The highest stage of the flood was determined by high-water marks to be 7.63 feet, and probably occurred about June 10.

Rating tables for Jocko River at Ravalli, Mont.

OCTOBER 18, 1906, TO JUNE 1, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	92	2.20	292	3.10	655	4.00	1,280
1.40	108	2.30	324	3.20	705	4.10	1,380
1.50	124	2.40	358	3.30	760	4.20	1,490
1.60	142	2.50	394	3.40	815	4.30	1,610
1.70	162	2.60	432	3.50	875	4.40	1,730
1.80	184	2.70	472	3.60	940	4.50	1,860
1.90	208	2.80	514	3.70	1,010		
2.00	234	2.90	558	3.80	1,090		
2.10	262	3.00	605	3.90	1,180		

JUNE 10, 1908, TO DECEMBER 31, 1908.[b]

Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	130	2.80	266	3.60	456	4.40	731
2.10	145	2.90	286	3.70	486	4.50	770
2.20	160	3.00	307	3.80	518	4.60	810
2.30	176	3.10	329	3.90	551	4.70	850
2.40	193	3.20	352	4.00	585	4.80	890
2.50	210	3.30	376	4.10	620		
2.60	228	3.40	401	4.20	656		
2.70	247	3.50	428	4.30	693		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 9 discharge measurements made during 1906–1908 and is fairly well defined.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based upon 5 discharge measurements made after June 25, 1908, and is well defined between gage heights 2.5 feet and 5.0 feet. Above gage height 5.0 feet, it is somewhat uncertain.

Monthly discharge of Jocko River at Ravalli, Mont., for 1906 to 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.					
October 18–31	262	152	179	4,970	B.
November	493	162	224	13,300	B.
December	208	173	188	11,600	B.
1907.					
January	184	152	166	10,200	B.
February	324	173	200	11,100	B.
March	324	196	246	15,100	B.
April	472	234	344	20,500	A.
May[a]	1,500	308	842	51,800	B.
June[a]	1,860	815	1,190	70,800	C.
July	1,180	358	585	36,000	C.
August	376	262	312	19,200	A.
September	277	234	245	14,600	A.
October	234	184	208	12,800	A.
November	184	162	177	10,500	A.
December	162	142	157	9,650	A.
The year	1,860	142	389	282,000	
1908.					
January	142	108	125	7,690	B.
February	514	92	131	7,540	B.
March	142	92	114	7,010	B.
April	605	124	238	14,200	A.
May	760	324	550	33,800	A.
June[b]	7,500	731	2,410	143,000	D.
July	693	329	479	29,500	A.
August	329	286	302	18,600	A.
September	428	228	286	17,000	A.
October	247	210	220	13,500	A.
November	210	193	200	11,900	B.
December[b]	193	160	172	10,600	B.
The year	7,500	92	436	314,000	

[a] Discharge estimated for days when gage was not read.
[b] Discharges estimated June 2 to 24 and December 1 to 31.

BIG KNIFE CREEK NEAR JOCKO, MONT.

Big Knife Creek is a small stream that rises in the mountains and flows in a westerly direction until it joins the Jocko River about a mile north of the Jocko Agency.

The station, which was established August 19, 1908, is located near the small highway bridge which spans the creek about 2½ miles northeast of Jocko.

There are no ditches diverted from this stream. The water may possibly be utilized by the Reclamation Service. As the creek has a high altitude, it freezes over in cold weather. The gage datum has remained unchanged. The channel does not shift, except in extremely high water.

Discharge measurements of Big Knife Creek near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 1	C. E. Hewitt	8.5	13.4	.....	22.3
August 19	R. Richards	9.5	9.5	0.83	14.8
October 8	do	11.0	8.8	.73	13.0
November 5	Richards and Huch	11.0	8.7	.69	11.0

NOTE.—Measurements made by wading.

The following additional gage heights were obtained: August 22, 0.81 foot; August 26, 0.81 foot; August 30, 0.81 foot; September 2, 0.80 foot; September 4, 0.79 foot; September 8, 0.77 foot; October 19, 0.71 foot.

AGENCY CREEK NEAR JOCKO, MONT.

Agency Creek is a small stream that rises in the Mission Range and flows in a westerly direction until it joins Jocko River near Agency.

The station, which was established August 19, 1908, is located about 2 miles east of Jocko, just above the intake of the Matt ditch—the largest ditch leaving the stream. Smaller ditches are diverted below. The stream has a steep grade and a rapid flow. It partially freezes over during the colder months. Its flow is controlled by the melting snow in the mountains.

Discharge measurements of Agency Creek near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 5	C. E. Hewitt	16	19.1	.....	13.8
August 19	R. Richards	14	8.05	0.81	10.2
October 8	do	13.7	7.14	.72	7.6
November 5	Richards and Huch	17	7.47	.74	8.0

NOTE.—The following additional gage heights were obtained: August 22, 0.80 foot; August 26, 0.79 foot; August 30, 0.79 foot; September 4, 0.77 foot; September 8, 0.76 foot; September 21, 0.98 foot; September 25, 0.85 foot; October 18, 0.55 foot.

FINLEY CREEK NEAR JOCKO, MONT.

Finley Creek, a tributary of Jocko River, is formed by its East and West forks, which rise in the Mission Range and unite about one-eighth mile above the gaging stations.

The station, which was established August 19, 1908, is located at the ford 2½ miles south of Jocko and 3½ miles east of Arlee, and is 300 feet south of the Northern Pacific Railway. No ditches of importance are diverted from this creek, but possibilities are good and the Reclamation Service will utilize this water on the Jocko project.

The stream freezes over in the winter. The gage datum has remained unchanged. The accuracy of the measurements is good.

Discharge measurements of Finley Creek near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
August 10	C. E. Hewitt	14	23.1	.....	14.8
August 19	R. Richards	13	11.4	1.29	15.3
October 8	do	11	8.55	1.21	9.5
November 5	Richards and Huch	11	9.25	1.20	10.4

NOTE.—Measurements made by wading.

The following additional gage heights were obtained: August 26, 1.27 feet; August 30, 1.25 feet; September 21, 1.31 feet; October 18, 1.30 feet; October 27, 1.22 feet.

EAST FINLEY CREEK NEAR JOCKO, MONT.

East Finley, a small creek rising in the Mission Range and fed by melting snow in the mountains, unites with the West Fork to form Finley Creek.

The station, which was established August 18, 1908, to obtain data for irrigation, is 4 miles southeast of Jocko, 4½ miles east of Arlee, and is located just above the intake of the Indian ditch. This ditch, is the only diversion and in low water takes practically the entire flow of the stream. The gage is permanent and the datum has remained unchanged.

Discharge measurements of East Finley Creek near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 4	C. E. Hewitt	8.5	6.32	.....	12.8
August 18	R. Richards	8.0	5.85	1.40	9.4
October 8	do	12	7.7	1.39	7.7
November 5	Richards and Huch	12	9.2	1.43	8.3

NOTE.—The following additional gage heights were obtained: August 24, 1.39 feet; August 26, 1.37 feet; August 30, 1.38 feet; September 21, 1.68 feet; September 25, 1.52 feet; October 18, 1.64 feet. Measurements made by wading.

INDIAN DITCH NEAR JOCKO, MONT.

This station, which was established August 18, 1908, is located on the ditch just below its intake, 50 feet below the East Finley gage. The gage is in the flume and measurements can be made there or in the ditch. The data obtained are to determine the amount of water now used in the ditch. The ditch is about 4 miles long and irrigates land in the vicinity of Jocko Agency. The Reclamation Service contemplates enlarging it and increasing its capacity. During the irrigating season the ditch carries about 6 second-feet. Accuracy of measurements is fair.

Discharge measurements of Indian ditch near Jocko, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 18	R. Richards	8.0	4.03	0.28	5.5
October 8	do	7.5	5.35	.44	6.6
November 5	Richards and Huch	4.9	2.28	.40	5.7

The following additional gage heights were obtained: August 24, 0.29 foot; August 26, 0.28 foot; August 30, 0.28 foot; September 21, 0.57 foot; September 25, 0.45 foot; October 18, 0.54 foot.

VALLEY CREEK NEAR RAVALLI, MONT.

This station was established August 20, 1908, at the crossing of the highway between Jocko and Ravalli. It is 3 miles east of Ravalli, 8 miles west of Arlee, and near the mouth of the stream, which is a tributary of Jocko River. It was established in order to obtain comparative results. The gage is read only at times when the engineer visits it.

Data obtained on this creek are for use in connection with irrigation projects. An ordinary staff gage is placed on the left bank above the bridge. Measurements are made by wading.

Discharge measurements of Valley Creek near Ravalli, Mont., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 20	R. Richards	14	12.4	1.24	22.4
October 7	do	18	14.9	1.16	18.9
November 6	Richards and Huch	16	13.7	1.15	19.1

NOTE.—Measurements made by wading.

The following additional gage heights were obtained: September 15, 1.18 feet; October 14, 1.31 feet; November 20, 1.15 feet.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Clark Fork basin during 1908:

Miscellaneous measurements in Clark Fork drainage basin in 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
April 17	Spring Creek	Crow Creek	Ronan, Mont.		12.7
May 20	do	do	do		13.2
June 27	do	do	do		18.6
July 20	do	do	do		17.8
August 21	do	do	do		16.1
October 7	do	do	do		16.2
November 12	do	do	do		18.8
April 16	North Fork of Post Creek	Post Creek	do	1.63	2.9
May 19	do	do	do	2.48	20.2
July 19	do	do	do		29.6
October 6	do	do	do		6.5
November 9	do	do	do	1.97	5.9
April 20	Finley Creek	Jocko River	Arlee, Mont.		10.0
May 20	do	do	do		69.8

SPOKANE RIVER DRAINAGE BASIN.

DESCRIPTION.

Spokane River rises in Lake Cœur d'Alene in western Idaho, at an elevation of 2,124 feet above sea level, flows westward and northwestward and empties into Columbia River in the north-central part of Lincoln County, Wash. The river is used for both water power and irrigation. Large power plants are located at the falls at Spokane and at Post Falls, Idaho, and a large plant has recently been completed 9 miles below Spokane. The total water power developed from this stream aggregates 45,000 horsepower. Irrigation is practiced in the valley of Spokane River and its tributaries.

The mean annual rainfall at Spokane is 17 inches, an amount which is fairly representative of the drainage area.

The following gaging stations have been maintained in this river basin:

Spokane River at Spokane (1896 to 1908).
Little Spokane River near Spokane (1903 to 1905).
Hangman Creek at and near Tekoa (1904 and 1905).
North Fork of Hangman Creek near Spokane (1904 and 1905).

SPOKANE RIVER AT SPOKANE, WASH.

This station was originally established October 17, 1906, and the records are practically continuous since that date, although the location of the station has been changed from time to time in order to secure better gaging conditions. The station is above the mouth of Hangman Creek, and there are no important tributaries above the station. The present location is at Martha street crossing, one-fourth mile above the Mission Street Bridge, a cable station being

established at this point April 11, 1904. The gage was located on the piers of the Mission Street Bridge and was read until March 1, 1907. Since that date the gage at the cable has been used for daily observations. The gages at Mission street and Martha street were read simultaneously during March, 1907, to determine the relation between them, and the records for January and February have been reduced to Martha street gage. The datum of the Martha street gage is 1,851.926 feet above sea level.

The data at this station are valuable in connection with both water power and irrigation development. The water power developed within a short distance of the gaging station probably aggregates 45,000 horsepower.

The conditions at the present gaging site are favorable for good results. The channel is not always stable, and slight changes occur which make it necessary to modify the rating curve from time to time, particularly for the lower stages.

Excessive and damaging floods are hardly possible on this stream, as the flow is controlled by natural storage in Lake Cœur d'Alene.

Discharge measurements of Spokane River at Spokane, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				Mission street gage.	Martha street gage.	
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
January 5	H. D. McGlashan	209	2,650	5.70	21.52	8,620
April 23	do	251	3,710	10.10	25.70	20,500
1908.						
September 4 [a]	L. R. Allen	202	1,720	.....	17.25	1,740

[a] Made with defective meter; discarded.

NOTE.—To determine the gage heights of measurements made 1904–1906, referred to Martha street gage, see table of relation of gage heights, page 119.

Daily gage height, in feet, of Spokane River at Spokane, Wash., for 1907 and 1908.

[A. C. Lingle, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	21.79	18.71	23.44	22.95	25.05	25.84	20.64	17.83	17.96	17.72	17.58	17.40
2	21.75	18.71	23.50	22.87	24.87	25.74	20.56	17.80	17.52	17.77	17.57	17.34
3	21.71	18.74	23.50	22.90	24.70	25.67	20.48	17.73	17.54	17.75	17.61	17.35
4	21.70	18.82	23.45	22.95	24.60	25.60	20.40	17.83	17.52	17.70	17.60	17.35
5	21.67	18.89	23.30	23.05	24.55	25.50	20.19	17.73	17.56	17.64	17.56	17.44
6	21.52	18.90	23.15	23.14	24.53	25.28	20.30	17.70	17.57	17.73	17.54	17.30
7	21.58	18.88	23.02	23.20	24.53	25.15	20.15	17.74	17.70	17.60	17.50	17.30
8	21.55	19.00	22.90	23.30	24.63	25.03	20.38	17.66	17.59	17.67	17.55	17.35
9	21.52	19.39	22.64	23.40	24.73	24.87	20.36	17.51	17.64	17.61	17.55	17.37
10	21.34	19.24	22.46	23.47	24.87	24.70	20.30	17.85	17.65	17.63	17.48	17.37
11	21.13	19.58	22.42	23.67	25.25	24.51	19.93	17.56	17.72	17.62	17.45	17.36
12	20.88	19.85	22.36	24.05	25.60	24.34	19.36	17.80	17.75	17.59	17.55	17.37
13	20.80	20.13	22.34	24.43	25.90	24.15	19.87	17.63	17.75	17.72	17.55	17.45
14	20.62	21.18	22.24	24.70	26.10	23.97	19.80	17.60	17.85	17.65	17.53	17.39
15	20.46	21.19	22.20	52.02	26.15	23.50	19.82	17.65	17.80	17.66	17.51	17.50

Daily gage height, in feet, of Spokane River at Spokane, Wash., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	20.28	21.21	22.10	25.46	26.17	23.39	18.79	17.60	17.78	17.64	17.60	17.30
17	19.94	21.57	21.94	25.80	26.22	23.22	18.32	17.58	17.82	17.65	17.58	17.42
18	19.81	21.57	21.87	26.08	26.42	22.72	18.14	17.73	17.70	17.64	17.55	17.38
19	19.77	21.56	21.80	26.20	26.57	22.49	18.08	17.52	17.60	17.68	17.70	17.47
20	19.65	21.54	21.90	26.21	26.83	22.14	17.95	17.61	17.63	17.75	17.45	17.50
21	19.58	21.52	22.30	26.10	27.08	22.03	17.85	17.67	17.57	17.63	17.30	17.60
22	19.42	21.68	22.92	25.90	27.19	21.95	17.84	17.58	17.67	17.73	17.55	17.60
23	19.37	21.83	23.40	25.78	27.22	21.85	17.82	17.62	17.65	17.73	17.55	17.40
24	19.24	22.01	23.62	25.60	27.20	21.82	17.77	17.44	17.75	17.76	17.32	17.45
25	19.10	22.28	23.75	25.72	27.06	21.75	17.80	17.50	17.73	17.73	17.52	17.52
26	18.90	22.73	23.72	25.70	26.85	21.49	17.80	17.51	17.73	17.80	17.46	17.35
27	18.81	23.04	23.68	25.66	26.64	21.14	17.89	17.42	17.73	17.75	17.55	17.50
28	18.77	23.31	23.59	25.57	26.43	20.78	17.84	17.46	17.74	17.72	17.55	17.47
29	18.74	.....	23.42	25.45	26.24	20.70	17.75	17.47	17.76	17.78	17.30	17.53
30	18.70	.....	23.30	25.25	26.10	20.66	17.83	17.47	17.70	17.72	17.35	17.42
31	18.68	.....	23.10	.....	26.93	.....	17.83	17.56	.....	17.55	.....	17.48
1908.												
1	17.60	17.25	18.50	22.70	26.62	23.83	18.40	17.48	17.26	17.14	17.34	17.63
2	17.43	17.35	18.60	22.45	26.40	23.76	18.30	17.52	17.10	17.23	17.45	17.57
3	17.42	17.32	18.25	22.28	26.28	23.60	18.20	17.47	17.15	17.30	17.45	17.65
4	17.45	17.35	18.50	22.04	26.28	23.52	18.08	17.50	17.18	17.25	17.50	17.62
5	17.46	17.45	18.55	21.87	26.30	23.46	18.04	17.42	17.18	17.26	17.57	17.70
6	17.35	17.46	18.49	21.70	26.20	23.50	17.95	17.55	17.20	17.27	17.60	7.75
7	17.40	17.50	18.55	21.62	26.08	23.52	18.10	17.40	17.25	17.25	17.62	17.65
8	17.42	17.52	18.55	21.45	26.07	23.62	18.15	17.56	17.10	17.28	17.55	17.64
9	17.45	17.50	18.65	21.30	26.12	23.67	18.08	17.50	17.15	17.26	17.50	17.60
10	17.43	17.45	18.50	21.20	26.22	23.54	18.00	17.49	17.16	17.30	17.62	17.62
11	17.42	17.47	18.50	21.08	26.23	23.64	17.95	17.52	17.17	17.28	17.57	17.65
12	17.45	17.46	18.55	21.15	26.10	23.62	17.80	17.43	17.19	17.15	17.53	17.67
13	17.35	17.48	18.60	21.33	25.90	23.62	17.65	17.45	17.20	17.32	17.58	17.68
14	17.38	17.52	18.96	21.50	25.73	23.58	17.88	17.60	17.20	17.28	17.61	17.64
15	17.33	17.49	19.52	22.40	25.52	23.52	17.91	17.57	17.10	17.22	17.67	17.60
16	17.47	17.55	20.97	22.80	25.30	23.44	17.85	17.52	17.15	17.18	17.61	17.58
17	17.55	17.45	22.30	23.23	25.12	23.38	17.83	17.65	17.20	17.23	17.55	17.60
18	17.47	17.46	23.60	23.66	24.99	23.25	17.77	17.35	17.15	17.51	17.59	17.62
19	17.48	17.45	24.10	24.10	24.87	23.09	17.82	17.35	17.12	17.30	17.58	17.68
20	17.38	17.48	24.28	24.57	24.70	22.94	17.78	17.29	17.18	17.22	17.60	17.75
21	17.45	17.55	24.23	25.10	24.58	22.78	17.78	17.35	17.05	17.10	17.63	17.50
22	17.35	17.55	24.00	25.67	24.50	22.60	17.85	17.35	17.17	17.25	17.65	17.65
23	17.45	17.50	23.80	26.15	24.39	22.42	17.87	17.45	17.30	17.33	17.65	17.75
24	17.45	17.47	23.60	26.70	24.27	22.17	17.80	17.33	17.35	17.30	17.57	17.68
25	17.47	17.52	23.50	27.04	24.22	21.64	17.81	17.35	17.32	17.40	17.56	17.70
26	17.46	17.54	23.42	27.25	24.18	21.08	17.78	17.29	17.25	17.20	17.60	17.55
27	17.44	17.90	23.41	27.35	24.10	20.64	17.66	17.25	17.32	17.25	17.62	17.60
28	17.40	17.90	23.35	27.25	24.02	20.10	17.58	17.35	17.30	17.32	17.60	17.60
29	17.48	18.00	23.18	27.10	24.00	19.42	17.60	17.37	17.20	17.20	17.65	17.59
30	17.47	.....	23.04	26.90	23.90	19.10	17.56	17.35	17.17	17.26	17.67	17.57
31	17.40	.....	22.90	.....	23.87	.....	17.47	17.35	.....	17.23	.....	17.55

NOTE.—All gage heights refer to Martha street gage. The river does not freeze at this point, as there is an underground flow of water through the gravel, which comes back into the river above the station.

Table of relation of gage heights on Spokane River at Spokane, Wash.

Mission street gage	Martha street gage.	Mission street gage.	Martha street gage.
Feet.	*Feet.*	*Feet.*	*Feet.*
0.00	15.25	7.00	22.70
1.00	16.35	8.00	23.70
2.00	17.45	9.00	24.70
3.00	18.55	10.00	25.70
4.00	19.60	11.00	26.70
5.00	20.65	12.00	27.70
6.00	21.70		

NOTE.—The above table is based on comparative readings of the two gages, March to July, 1907, and at times of four discharge measurements and is well defined.

Rating table for Spokane River at Spokane, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
17.00	1,630	18.30	3,325	19.60	5,450	21.80	9,750
17.10	1,740	18.40	3,475	19.70	5,625	22.00	10,200
17.20	1,860	18.50	3,625	19.80	5,800	22.20	10,650
17.30	1,980	18.60	3,775	19.90	5,975	22.40	11,150
17.40	2,100	18.70	3,925	20.00	6,150	22.60	11,650
17.50	2.225	18.80	4,075	20.20	6,550	22.80	12,150
17.60	2,350	18.90	4,225	20.40	6,950	23.00	12,650
17.70	2,475	19.00	4,400	20.60	7,350	24.00	15,350
17.80	2,600	19.10	4,575	20.80	7,750	25.00	18,275
17.90	2,725	19.20	4,750	21.00	8,150	26.00	21,550
18.00	2,875	19.30	4,925	21.20	8,550	27.00	25,050
18.10	3,025	19.40	5.100	21.40	8,950	28.00	28,650
18.20	3,175	19.50	5,275	21.60	9,350		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 24 discharge measurements made during 1906–1908, that were referred to the Martha street gage, 20 others referred to Mission street gage, and the relation between the gages, and is well defined.

Monthly discharge of Spokane River at Spokane, Wash., for 1907 and 1908.

[Drainage area, 4,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	9,730	3,900	6,820	1.70	1.96	419,000	A.
February	13,500	3,940	7,540	1.88	1.96	419,000	A.
March	14,700	9,750	12,400	3.10	3.57	762,000	A.
April	22,300	12,300	17,400	4.35	4.85	1,040,000	A.
May	25,800	16,900	21,400	5.35	6.17	1,320,000	A.
June	21,000	7,470	14,100	3.52	3.93	839,000	A.
July	7,430	2,540	4,610	1.15	1.33	283,000	A.
August	2,660	2,120	2,380	.595	.69	146,000	A.
September	2,820	2,250	2,460	.615	.69	146,000	A.
October	2,600	2,290	2,460	.615	.71	151,000	A.
November	2,480	2,000	2,250	.562	.63	134,000	A.
December	2,350	2,000	2,130	.532	.61	131,000	A.
The year	25,800	2,000	8,000	2.00	27.10	5,790,000	
1908.							
January	2,350	2,020	2,150	.538	.62	132,000	A.
February	2,880	1,920	2,240	.560	.60	129,000	A.
March	16,100	3,250	8,900	2.22	2.56	547,000	A.
April	26,300	8,310	15,200	3.80	4.24	904,000	A.
May	23,700	15,000	19,200	4.80	5.53	1,180,000	A.
June	14,900	4,580	12,200	3.05	3.40	726,000	A.
July	3,480	2,190	2,720	.680	.78	167,000	A.
August	2,410	1,920	2,140	.535	.62	132,000	A.
September	2,040	1,680	1,850	.462	.52	110,000	A.
October	2,240	1,740	1,930	.482	.56	119,000	A.
November	2,440	2,030	2,320	.580	.65	138,000	A.
December	2,540	2,220	2,390	.598	.69	147,000	A.
The year	26,300	1,680	6,100	1.53	20.77	4,430,000	

OKANOGAN RIVER DRAINAGE BASIN.

DESCRIPTION.

Okanogan River rises in Okanogan Lake, in British Columbia, and flows southward, entering Columbia River near Brewster, Wash. Its course in Canada lies through a series of narrow lakes. The drainage area is comparatively rough and mountainous, and is timbered except along the river. The rainfall is approximately 20 inches

per annum. The principal tributaries in the United States are Similkameen and Conconully rivers and Antwine, Bonaparte, Salmon, and Johnson creeks.

The main stream is navigable from Brewster to Riverside, except during low-water periods, while the tributaries are used largely for irrigation.

The following gaging stations have been maintained in this river basin:

Sinlaheekin Creek near Loomis (1903 to 1905).
Johnson Creek near Riverside (1903 to 1907).
Salmon Creek near Malott (1903 to 1908).

JOHNSON CREEK NEAR RIVERSIDE, WASH.

Johnson Creek is a very small stream, but as the water rights are not settled a record of its flow was necessary in the development of the Okanogan project. This station, which was established May 30, 1903, and abandoned December 31, 1907, was located near the mouth of the stream. The equipment consists of a rectangular weir, 8 feet long. On March 7, 1907, the crest of the weir was level, but the zero of the gage was one-tenth higher than the crest of the weir during 1905 to 1907. The post to which it was fastened probably had been raised by ice. The datum of the gage was 1,228.63 feet above sea level.

Daily discharge, in second-feet, of Johnson Creek near Riverside, Wash., for 1907.

[Mrs. D. T. Williams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.0	7.6	7.3	4.6	2.4	2.2	2.2	2.8	3.4	4.6	5.3
2	4.9	3.0	7.6	7.3	4.6	2.6	1.9	2.4	3.2	3.6	4.6	5.3
3	5.1	3.0	7.9	7.6	4.2	2.6	2.1	2.4	3.2	3.6	4.6	5.3
4	5.1	2.8	7.9	7.6	4.4	2.6	2.6	2.4	3.0	4.0	4.4	5.6
5	4.9	2.6	7.9	8.4	4.0	2.8	2.4	2.4	3.2	4.0	4.6	5.3
6	4.9	2.6	7.6	8.4	3.6	3.8	2.6	2.4	3.2	3.8	4.6	5.3
7	4.4	2.8	7.9	7.9	4.0	2.1	2.6	2.8	2.8	3.6	4.6	5.6
8	3.8	3.0	8.1	7.6	3.6	2.2	2.8	2.8	2.8	3.6	4.6	5.8
9	4.0	3.0	8.4	7.6	3.0	1.7	1.9	2.8	3.0	3.6	4.6	5.3
10	4.0	3.4	9.5	7.1	3.0	1.9	1.7	2.6	3.2	3.8	4.6	5.6
11	3.6	4.2	8.4	7.1	3.2	2.6	2.2	2.4	3.6	3.6	4.9	6.1
12	3.6	4.9	8.1	6.8	3.0	4.6	2.1	2.2	4.0	3.8	4.6	6.3
13	3.4	5.6	7.6	7.1	2.1	5.3	2.4	2.4	4.0	4.2	4.9	7.6
14	3.4	6.4	8.4	6.6	2.4	2.2	2.2	2.2	3.6	3.8	4.9	7.6
15	3.4	7.1	8.1	6.8	2.4	2.4	3.4	2.1	3.6	4.0	5.1	6.8
16	3.0	6.8	8.4	6.6	1.7	2.2	3.0	2.1	4.0	4.2	5.1	5.8
17	3.0	7.3	8.1	7.1	1.3	2.2	2.8	1.4	4.0	4.0	5.1	19.3
18	3.0	6.6	8.1	7.1	2.4	2.4	2.4	1.4	4.0	4.0	4.9	16.4
19	3.4	6.6	8.7	7.1	5.1	2.4	3.2	1.9	3.8	4.2	4.9	13.2
20	4.4	6.6	8.4	7.1	7.1	2.6	2.6	1.9	3.8	4.2	4.9	7.9
21	5.3	6.6	7.9	6.8	6.3	2.8	2.4	2.1	3.6	4.0	4.9	5.8
22	5.3	6.6	8.1	7.1	5.8	4.0	3.0	2.1	3.6	3.8	4.9	5.6
23	4.9	6.6	8.4	6.8	4.9	4.4	2.6	1.6	3.8	4.0	4.9	4.6
24	4.9	6.8	7.6	6.3	4.9	2.8	2.6	1.4	3.6	4.0	4.9	5.8
25	4.9	6.8	8.1	5.8	4.2	3.0	2.8	1.6	3.4	4.0	4.9	5.6
26	4.9	7.9	7.9	5.6	4.0	3.0	2.8	1.7	3.2	4.0	5.3	12.8
27	4.9	7.6	7.9	5.6	3.6	3.0	2.6	2.1	3.2	4.0	4.9	17.5
28	2.8	7.6	7.9	5.8	4.0	2.8	2.4	2.2	3.0	3.8	5.3	5.1
29	2.8	.....	7.6	6.3	3.8	3.4	2.6	2.8	3.2	3.8	5.6	4.2
30	3.0	.....	7.6	5.8	3.0	2.4	2.2	2.8	3.4	4.0	5.6	5.1
31	3.2	.....	7.6	.....	2.8	.....	2.2	2.8	.....	4.4	.....	5.1

NOTE.—These discharges were obtained from the Ceppoletti weir formula, using gage heights corrected to give head on crest of weir.

Monthly discharge of Johnson Creek near Riverside, Wash., for 1907.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	5.3	2.8	4.06	0.062	0.07	250	B.
February	7.9	2.6	5.28	.080	.08	293	B.
March	9.5	7.6	8.04	.122	.14	494	B.
April	8.4	5.6	6.94	.105	.12	413	B.
May	7.1	1.3	3.77	.057	.07	232	B.
June	5.3	1.7	2.84	.043	.05	169	B.
July	3.4	1.7	2.49	.038	.04	153	B.
August	2.8	1.4	2.21	.033	.04	136	B.
September	4.0	2.8	3.43	.052	.06	204	B.
October	4.4	3.4	3.90	.059	.07	240	B.
November	5.6	4.4	4.88	.074	.08	290	B.
December	19.3	4.2	7.37	.112	.13	453	B.
The year	19.3	1.3	4.60	.070	.95	3,330	

SALMON CREEK NEAR MALOTT, WASH.

This station, which was established May 27, 1903, is located on the stage road between Malott and Conconcully, 14 miles from Malott and 11 miles from Conconcully, and is 6 miles above the mouth of the stream. The waters of this creek are used for storage in the development of the Okanogan project of the United States Reclamation Service, which has recently been completed. About 20,000 acres of land have been brought under irrigation and are at present open to settlement under the terms of the reclamation act.

The conditions at the station are favorable for good results if a sufficient number of measurements are made each year. The bed of the creek, however, is not stable, and a number of rating curves have been used. The measurements have been made by the engineers of the Okanogan project, and the results furnished to the Geological Survey, but they are too incomplete to form an accurate basis for estimates of flow.

Discharge measurements of Salmon Creek near Malott, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	O. Laurgaard	23	25	0.74	14
April 18[a]	H. D. McGlashan	24	30	.94	32
1908.					
May 9[b]	Laurgaard and Albertson	26	46	1.68	99
June 8	do	25	64	2.15	194

[a] Operation of sawmill above station interfered with measurement.
[b] Made 4 feet below regular section.

Daily gage height, in feet, of Salmon Creek near Malott, Wash., for 1907 and 1908.

[Forrest Jones, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.62	0.64	0.67	0.67	1.38	2.58	1.38	0.69	0.79	0.71	0.69	0.67
2	.60	.62	.67	.69	1.46	2.42	1.33	.75	.78	.69	.75	.69
3	.57	.58	.62	.71	1.50	2.25	1.33	.75	.82	.69	.75	.67
4	.61	.58	.64	.69	1.54	2.25	1.33	1.00	.83	.71	.77	.68
5	.60	.58	.67	.69	1.67	2.19	1.35	1.00	.83	.73	.75	.71
6	.64	.60	.67	.67	1.64	2.08	1.29	1.02	.79	.67	.75	.71
7	.62	.62	.65	.67	1.71	2.05	1.25	1.05	.75	.71	.75	.69
8	.65	.62	.65	.71	1.88	1.96	1.21	1.05	.74	.69	.75	.67
9	.62	.60	.64	.75	2.00	1.91	1.19	1.06	.71	.69	.75	.64
10	.62	.62	.67	.83	1.98	1.96	1.17	1.12	.69	.67	.74	.67
11	.64	.62	.67	.85	2.00	1.88	1.17	1.08	.71	.69	.75	.62
12	.62	.60	.64	.92	1.92	2.08	1.08	1.05	.83	.68	.71	.58
13	.58	.62	.67	.98	1.83	2.00	1.08	1.02	.79	.67	.75	.60
14	.58	.60	.67	1.06	1.92	1.83	1.10	.99	.75	.69	.67	.58
15	.60	.58	.67	1.00	2.10	1.75	1.08	.96	.83	.67	.69	.62
16	.62	.58	.58	1.05	2.27	1.71	1.09	.94	1.06	.67	.69	.67
17	.62	.60	.62	1.00	2.32	1.67	1.08	.92	1.00	.67	.67	.67
18	.60	.62	.62	1.08	2.21	1.67	1.08	.90	.96	.68	.54	.67
19	.58	.62	.67	1.08	2.50	1.67	1.10	.90	.83	.69	.62	.69
20	.58	.62	.67	1.05	2.67	1.67	1.08	.88	.79	.68	.65	.67
21	.60	.64	.67	1.08	2.54	1.58	1.06	.92	.79	.67	.71	.67
22	.62	.62	.69	1.12	2.42	1.60	1.00	.88	77	.67	.74	.62
23	.58	.64	.67	1.17	2.38	1.62	.96	.83	.75	.69	.71	.67
24	.60	.62	.67	1.25	2.35	1.67	1.00	.83	.79	.67	.71	.69
25	.58	.64	.64	1.29	2.33	1.71	.96	.85	.75	.67	.73	.69
26	.58	.67	.64	1.31	2.31	1.56	.92	.87	.75	.69	.74	.67
27	.60	.67	.67	1.33	2.31	1.52	.90	.90	.73	.69	.71	.68
28	.59	.64	.69	1.35	2.33	1.50	.88	.88	.73	.71	.73	.71
29	.62	.....	.69	1.33	2.40	1.50	.75	.85	.71	.71	.71	.71
30	.62	.....	.67	1.33	2.42	1.46	.71	.83	.69	.67	.67	.71
31	.67	.....	.71	.....	1.56	.....	.75	.81	.....	.67	.....	.69
1908.												
1	.71	.54	.71	.73	1.31	1.94	1.05	.79	.69	.59	.71	.62
2	.69	.58	.73	.69	1.46	1.90	1.05	.75	.67	.60	.73	.62
3	.67	.56	.73	.67	1.67	1.90	1.00	.67	.67	.58	.71	.54
4	.69	.58	.75	.75	1.54	1.88	1.00	.73	.64	.58	.67	.55
5	.67	.58	.75	.75	1.54	1.88	.92	.92	.62	.59	.67	.56
6	.62	.60	.75	.71	1.58	2.09	.83	.98	.62	.50	.69	.58
7	.67	.58	.79	.67	1.77	2.14	.74	.96	.58	.50	.67	.58
8	.67	.56	.77	.69	1.67	2.21	.79	1.00	.60	.44	.69	.62
9	.69	.58	.79	.75	1.62	2.25	.82	1.05	.60	.44	.71	.60
10	.69	.60	.79	.75	1.67	2.25	.81	1.00	.62	.42	.67	.61
11	.71	.62	.78	.81	1.98	2.23	.79	.96	.60	.42	.69	.62
12	.69	.62	.79	.88	1.96	2.12	.75	1.00	.58	.40	.67	.64
13	.71	.60	.79	1.00	1.83	2.00	.79	.96	.59	.41	.67	.62
14	.67	.62	.81	1.08	1.79	1.96	.83	.94	.58	.40	.67	.60
15	.67	.62	.82	1.17	1.71	1.92	.85	1.05	.60	.40	.69	.58
16	.69	.67	.79	1.33	1.94	1.84	.94	1.00	.58	.40	.67	.58
17	.68	.67	.77	1.33	1.79	1.83	1.02	.98	.58	.40	.67	.60
18	.67	.64	.71	1.33	1.75	1.83	1.08	.96	.59	.46	.71	.59
19	.68	.64	.69	1.31	1.71	1.77	1.05	.94	.60	1.20	.67	.58
20	.69	.67	.64	1.42	1.67	1.73	1.00	.92	.60	.75	.71	.58
21	.58	.67	.67	1.25	1.75	1.58	.88	.96	.58	.71	.75	.60
22	.58	.67	.75	1.25	1.83	1.50	.83	.92	.58	.67	1.17	.58
23	.60	.64	.79	1.21	1.83	1.48	.75	.83	.59	.67	1.00	.58
24	.59	.67	.92	1.21	1.82	1.38	.75	.88	.58	.69	.96	.58
25	.62	.64	.92	1.19	1.92	1.42	.67	.94	.58	.67	.83	.60
26	.60	.67	.88	1.12	1.85	1.29	.58	.96	.59	.67	.73	.58
27	.62	.69	.83	1.14	1.81	1.21	.60	.83	.60	.67	.71	.58
28	.64	.71	.77	1.14	1.83	1.17	.64	.71	.58	.69	.71	.59
29	.60	.69	.79	1.17	1.96	1.12	.67	.67	.59	.67	.70	.56
30	.58	.....	.75	1.21	1.92	1.08	.83	.69	.58	.71	.71	.59
31	.54	.....	.73	.....	1.96	.....	.83	.67	.....	.67	.....	.54

NOTE.—The creek never freezes at the gage.

Rating tables for Salmon Creek near Malott, Wash.

1906 AND 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	5	1.10	41	1.80	154	2.50	316
.50	7	1.20	53	1.90	174	2.60	343
.60	9	1.30	66	2.00	194	2.70	371
.70	12	1.40	81	2.10	215	2.80	400
.80	17	1.50	98	2.20	238	2.90	432
.90	24	1.60	116	2.30	263		
1.00	31	1.70	134	2.40	289		

1908.[b]

0.40	3	0.90	22	1.40	72	1.90	149
.50	5	1.00	29	1.50	85	2.00	167
.60	8	1.10	37	1.60	100	2.10	185
.70	12	1.20	48	1.70	115	2.20	204
.80	17	1.30	60	1.80	131	2.30	224

[a] This table is not applicable for ice or obstructed channel conditions. It is based on 5 discharge measurements made in 1905–1907, and is well defined between gage heights 0.7 foot and 2.6 feet.

[b] This table is not applicable for ice or obstructed channel conditions. It is based on discharge measurements made during 1903–1908, and is not well defined.

Monthly discharge of Salmon Creek near Malott, Wash., for 1906 to 1908.

[Drainage area, 152 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	14.5	11.1	12.6	0.083	0.10	775	C.
February	22.0	8.2	12.2	.080	.08	678	C.
March	84.0	10.8	16.4	.108	.12	1,010	C.
April	109	41	70.3	.462	.52	4,180	B.
May	386	52	109	.717	.83	6,700	B.
June	260	91	158	1.04	1.16	9,400	B.
July	91	19.1	43.5	.286	.33	2,670	B.
August	25	7.0	12.0	.079	.09	738	C.
September	10.2	5.8	7.63	.050	.06	454	C.
October	13.5	7.8	10.1	.066	.08	621	C.
November	78	11.7	19.9	.131	.15	1,180	C.
December	13.5	6.2	11.5	.076	.09	707	C.
The year	386	5.8	40.3	.265	3.61	29,100	
1907.							
January	11.1	8.4	9.29	.061	.07	571	C.
February	11.1	8.6	9.54	.063	.07	530	C.
March	12.5	8.6	10.8	.071	.08	664	C.
April	74	11.1	35.3	.232	.26	2,100	B.
May	363	78	214	1.41	1.63	13,200	B.
June	338	91	166	1.09	1.22	9,880	B.
July	78	12.5	42.6	.280	.32	2,620	C.
August	43	11.7	26.1	.172	.20	1,600	C.
September	37.0	11.7	17.2	.113	.13	1,020	C.
October	13.5	11.1	11.6	.076	.09	713	C.
November	15.5	7.8	12.9	.085	.09	768	C.
December	12.5	8.6	11.1	.073	.08	682	C.
The year	363	7.8	47.2	.310	4.24	34,300	
1908.							
January	12.5	6.2	10.1	.066	.08	621	C.
February	12.5	6.2	9.16	.060	.06	527	C.
March	23.0	9.6	15.7	.103	.12	965	C.
April	75.0	10.8	35.7	.235	.26	2,120	C.
May	163.0	61.0	125	.822	.95	7,690	B.
June	214.0	35.0	131	.862	.96	7,800	B.
July	35.0	6.2	20.0	.132	.15	1,230	C.
August	33.0	10.8	22.5	.148	.17	1,380	C.
September	11.6	7.4	8.17	.054	.06	486	C.
October	59.0	3.0	9.11	.060	.07	560	C.
November	45.0	10.8	14.2	.093	.10	845	C.
December	9.6	5.0	7.62	.050	.06	469	C.
The year	214.0	3.0	34.0	.224	3.04	24,700	

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Okanogan River drainage basin in 1907:

Miscellaneous measurements in Okanogan River drainage basin in 1907.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
April 17	Okanogan River	Columbia River	Highway bridge, Riverside, Wash.	[a] −3.25	2,000
April 16	Loup Loup Creek	Okanogan River	Malott, Wash		[b] 26
April 19	Chiliwist Creek	do	do		[b] 7

[a] Below 40d. spike on top of stump on left bank, 25 feet below bridge. Extreme low water is about 1 foot below this gage.
[b] Estimated.

METHOW RIVER DRAINAGE BASIN.

METHOW RIVER AT PATEROS, WASH.

Methow River rises on the eastern slope of the Cascade Mountains in the northern part of Okanogan County and flows southeastward, uniting with Columbia River near Pateros. It is about 60 miles long, and its drainage basin, which lies west of the Okanogan basin and east of that of Lake Chelan, comprises about 1,700 square miles. The most important tributaries of the Methow are its East Fork, which joins it near Winthrop, and Twisp River, which enters from the west at Twisp.

The country is rough and mountainous and lightly forested. The mean annual rainfall ranges from 70 to 80 inches on the summit of the Cascades to about 15 inches at the mouth of the river. Irrigation is not practiced except on the lands lying contiguous to the streams.

The gaging station, which was established November 9, 1903, is located about 1 mile above the mouth of the river and the town of Pateros. No tributaries enter in the immediate vicinity of the station. During the winter months observations are sometimes complicated by ice, although the difficulty has not been serious. The conditions at the station are favorable for good results, and it is believed the records are as reliable as could be expected with the few measurements it has been possible to obtain during the past two years.

It is notable that the conditions which caused damaging floods on nearly all other streams draining the Cascade Range on November 14 to 16, 1906, did not have any effect on this river.

Discharge measurements of Methow River at Pateros, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 15	H. D. McGlashan	171	568	5.45	1,480
1908. September 30	L. R. Allen	145	292	3.94	391

Daily gage height, in feet, of Methow River at Pateros, Wash., for 1907 and 1908.

[W. Plessinger, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.0	5.2	4.25	4.35	6.1	10.8	7.5	5.4	4.4	4.45	4.2	4.15
2	3.9	5.2	4.25	4.4	6.2	9.9	7.2	5.35	4.35	4.45	4.2	4.15
3	4.05	5.1	4.3	4.45	6.4	9.6	7.25	5.35	4.35	4.4	4.15	4.15
4	3.95	5.0	4.3	4.45	6.45	9.4	7.4	5.3	4.05	4.4	4.15	4.15
5	3.95	5.0	4.3	4.5	6.7	9.4	7.1	5.2	4.05	4.4	4.15	4.1
6	3.95	5.0	4.3	4.6	6.95	9.3	6.8	5.1	4.05	4.35	4.15	4.1
7	3.95	5.0	4.3	4.6	7.4	8.8	6.25	5.05	4.05	4.35	4.1	4.1
8	4.05	5.05	4.3	.....	7.9	8.75	6.3	5.0	4.3	4.35	4.1	4.1
9	4.05	5.05	4.3	.....	8.2	8.4	6.55	5.0	4.3	4.3	4.1	4.05
10	4.05	5.05	4.3	.....	8.15	8.1	6.55	5.0	4.35	4.3	4.1	4.05
11	4.2	4.9	4.3	.....	8.1	8.0	6.6	4.9	4.35	4.3	4.1	4.05
12	4.35	4.9	4.3	.....	7.9	8.0	6.5	4.85	4.4	4.25	4.1	4.05
13	4.25	4.75	4.3	.....	7.65	7.7	6.4	4.8	4.4	4.25	4.1	4.05
14	4.15	4.65	4.3	.....	7.6	7.55	6.3	4.75	4.35	4.25	4.1	4.05
15	4.15	4.55	4.3	.....	8.0	7.3	6.3	4.7	4.4	4.25	4.1	4.0
16	4.4	4.55	4.3	5.5	9.7	7.15	6.35	4.65	4.45	4.2	4.05	3.95
17	4.45	4.55	4.3	5.7	9.8	7.1	6.25	4.65	4.45	4.2	4.05	3.9
18	4.5	4.5	4.3	5.8	9.6	7.3	6.2	4.6	4.45	4.2	4.05	3.95
19	4.55	4.5	4.3	5.8	9.6	7.7	6.2	4.6	4.5	4.2	4.05	3.95
20	4.9	4.5	4.3	5.75	9.7	7.8	6.1	4.55	4.5	4.2	4.05	4.05
21	5.0	4.5	4.3	5.75	9.4	8.0	6.05	4.5	4.5	4.15	4.1	4.1
22	5.1	4.4	4.3	5.9	8.9	7.8	6.05	4.5	4.5	4.15	4.1	4.1
23	5.0	4.45	4.3	6.45	8.8	7.5	6.0	4.45	4.5	4.15	4.1	4.1
24	4.95	4.5	4.3	6.35	8.9	7.5	5.9	4.45	4.5	4.15	4.1	4.15
25	4.95	4.45	4.3	6.25	8.8	7.5	5.8	4.45	4.5	4.15	4.1	4.15
26	6.0	4.4	4.3	6.2	8.85	8.0	5.6	4.55	4.5	4.15	4.1	4.1
27	6.0	4.3	4.3	6.15	8.9	8.5	5.55	4.55	4.5	4.15	4.1	4.05
28	5.75	4.25	4.3	6.1	9.4	8.3	5.55	4.5	4.45	4.1	4.15	4.05
29	5.65	.....	4.3	6.05	9.85	8.0	5.5	4.5	4.45	4.1	4.15	4.0
30	5.4	.....	4.35	6.1	10.0	7.7	5.45	4.55	4.45	4.1	4.15	4.0
31	5.2	.....	4.35	.....	10.7	.....	5.45	4.5	.....	4.1	.....	4.05
1908.												
1	4.05	3.75	3.9	4.25	6.0	8.0	7.7	5.1	4.4	3.95	3.95	4.0
2	4.1	3.7	3.85	4.25	6.35	8.0	7.8	5.0	4.4	3.95	3.95	3.9
3	4.1	3.9	3.85	4.25	6.65	8.2	7.6	4.95	4.35	3.95	3.95	3.9
4	4.05	4.1	3.85	4.3	6.6	8.3	7.35	4.9	4.35	3.95	3.95	3.9
5	4.0	4.2	3.85	4.3	6.65	8.4	7.05	4.9	4.3	3.95	4.0	3.9
6	4.0	4.15	3.85	4.3	6.65	8.8	7.0	4.85	4.3	3.95	4.0	3.9
7	3.95	4.1	3.85	4.3	7.2	9.2	6.9	4.8	4.25	3.95	4.0	3.95
8	3.95	4.1	3.85	4.3	7.35	9.8	6.8	4.8	4.25	3.95	4.0	4.0
9	4.0	4.15	3.85	4.35	7.4	10.3	6.75	4.75	4.2	3.95	4.05	4.05
10	4.0	4.15	3.85	4.4	7.4	10.3	6.7	4.7	4.2	3.9	4.05	4.05
11	3.95	4.1	3.9	4.5	7.45	10.3	6.6	4.65	4.15	3.9	4.0	4.05
12	3.95	4.05	3.9	4.5	7.35	10.2	6.6	4.65	4.1	3.9	4.0	4.05
13	3.95	4.0	3.95	4.75	7.3	9.5	6.65	4.6	4.1	3.9	4.0	4.05
14	4.0	4.05	4.0	5.0	7.25	9.5	7.0	4.6	4.1	3.9	3.95	4.0
15	3.95	4.0	4.05	5.5	7.15	9.4	7.05	4.55	4.1	3.9	4.0	3.95
16	3.95	4.0	4.1	5.1	7.1	9.2	7.0	4.55	4.1	3.9	4.0	4.0
17	3.9	4.0	4.1	5.15	7.05	8.8	6.9	4.5	4.05	3.9	4.0	3.95
18	4.0	3.95	4.1	5.2	7.05	8.4	6.8	4.5	4.05	3.9	4.05	3.9
19	4.0	3.9	4.05	5.25	7.1	8.0	6.55	4.5	4.05	3.9	4.05	3.8
20	4.0	3.9	4.05	5.3	7.2	7.7	6.5	4.5	4.05	3.95	4.2	3.85
21	3.9	3.9	4.05	5.4	7.3	7.4	6.4	4.5	4.05	3.95	4.2	3.9
22	3.8	3.85	4.05	5.5	7.4	7.2	6.3	4.5	4.0	3.95	4.25	3.95
23	3.85	3.85	4.1	5.6	7.45	7.2	6.2	4.6	4.0	3.95	4.2	4.0
24	3.85	3.9	4.15	5.7	7.45	7.4	6.1	4.55	4.0	3.9	4.2	3.95
25	3.85	3.9	4.25	5.8	7.5	7.8	5.95	4.55	4.0	3.9	4.15	3.95
26	3.8	3.9	4.25	5.75	7.6	7.6	5.8	4.5	4.0	3.95	4.1	3.95
27	3.75	3.9	4.25	5.7	7.65	7.5	5.65	4.5	4.0	3.95	4.1	3.95
28	3.75	3.85	4.25	5.75	7.75	7.2	5.5	4.5	4.0	3.95	4.1	4.0
29	3.95	3.85	4.2	5.75	8.0	7.05	5.4	4.45	3.95	3.95	4.1	4.0
30	3.8	.....	4.2	5.8	8.1	6.95	5.25	4.45	3.95	3.95	4.05	3.95
31	3.75	.....	4.25	.....	8.2	.....	5.2	4.45	.....	3.95	.....	4.0

NOTE.—Ice conditions from January 1 to February 28, 1907. River was not entirely frozen over. Ice reached a maximum thickness of 15 inches along the edges. Channel about one-third frozen over from January 15 to February 26, 1908.

Rating table for Methow River at Pateros, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	324	5.00	1,072	6.30	2,726	8.20	6,264
3.80	354	5.10	1,166	6.40	2,884	6.40	6,674
3.90	388	5.20	1,266	6.50	3,050	6.60	7,088
4.00	426	5.30	1,372	6.60	3,216	8.80	7,506
4.10	468	5.40	1,484	6.70	3,386	9.00	7,930
4.20	515	5.50	1,602	6.80	3,560	9.20	8,356
4.30	569	5.60	1,724	6.90	3,738	9.40	8,785
4.40	627	5.70	1,854	7.00	3,920	9.60	9,215
4.50	690	5.80	1,988	7.20	4,294	9.80	9,646
4.60	756	5.90	2,128	7.40	4,676	10.00	10,080
4.70	826	6.00	2,272	7.60	5,066	11.00	12,340
4.80	902	6.10	2,420	7.80	5,460		
4.90	984	6.20	2,572	8.00	5,860		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 6 discharge measurements made during 1905–1908, and the form of previous high-water curves, and is well defined between gage heights 4.0 feet and 11.6 feet. Above gage height 4.5 feet it is the same as the 1906 table.

Monthly discharge of Methow River at Pateros, Wash., for 1907 and 1908.

[Drainage area, 1,710 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	.....	.....	[a] 403	0.236	0.27	24,800	C.
February	.....	.....	[a] 451	.264	.27	25,000	C.
March	598	542	566	.331	.38	34,800	A.
April [b]	2,970	598	1,600	.936	1.04	95,200	B.
May	11,600	2,420	6,790	3.97	4.58	418,000	A.
June	11,900	4,110	6,360	3.72	4.15	378,000	A.
July	4,870	1,540	2,770	1.62	1.87	170,000	A.
August	1,480	658	916	.536	.62	56,300	A.
September	690	447	619	.362	.40	36,800	A.
October	658	468	541	.316	.36	33,300	A.
November	515	447	473	.277	.31	28,100	A.
December	492	388	453	.265	.31	27,900	B.
The year	.....	.....	1,830	1.07	14.56	1,330,000	
1908.							
January	468	339	402	.235	.27	24,700	B.
February	515	324	418	.244	.26	24,000	B.
March	542	371	441	.258	.30	27,100	A.
April	1,990	542	1,170	.684	.76	69,600	A.
May	6,260	2,270	4,410	2.58	2.97	271,000	A.
June	10,700	3,830	6,840	4.00	4.46	407,000	A.
July	5,460	1,270	3,220	1.88	2.17	198,000	A.
August	1,170	658	794	.464	.53	48,800	A.
September	627	407	486	.284	.32	28,900	A.
October	407	388	400	.234	.27	24,600	B.
November	542	407	450	.263	.29	26,800	A.
December	447	354	411	.240	.28	25,300	B.
The year	10,700	324	1,620	.947	12.88	1,180,000	

[a] Discharges estimated. [b] Discharge interpolated April 8 to 15.

MISCELLANEOUS MEASUREMENT.

A measurement of the Pateros ditch at the highway crossing, near K. K. Parker's ranch, near Pateros, April 15, 1907, gave a discharge of 3.8 second-feet. Water surface was 1.92 feet below top of bridge floor.

CHELAN RIVER DRAINAGE BASIN.

CHELAN RIVER AT CHELAN, WASH.

Chelan River, which enters Columbia River at Chelan Falls, forms the outlet of Chelan Lake, a narrow body of water, 48 miles long, lying at an elevation of 1,080 feet above sea level. The area contiguous to the lake is exceedingly rough and mountainous and lightly forested.

The mean annual rainfall at Chelan is 13 inches.

This station was established November 6, 1903. It is located just below the outlet of Chelan Lake, 4 miles northwest of Chelan Falls, in the town of Chelan.

The data obtained at this station are valuable principally for use in water-power development, as the river has a fall of 380 feet in the 4 miles between the outlet of the lake and the junction of the river with the Columbia.

Sufficient measurements have not been made to give good results at this station, as the channel appears to be somewhat shifting. The flow of the river is partially controlled by a dam at the foot of the lake.

Discharge measurements of Chelan River at Chelan, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 2	H. D. McGlashan	206	1,460	5.50	920
April 20	do	219	1,640	6.40	1,960
1908.					
October 1[a]	L. R. Allen	292	1,040	5.55	861

[a] Made with defective meter, discarded.

NOTE.—Measurements were made at different section from that used in 1903–1906.

Daily gage height, in feet, of Chelan River at Chelan, Wash., for 1907 and 1908.

[G. L. Richardson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	5.6	5.15	5.9	5.7	7.15	10.4	9.5	7.9	5.9	5.9	5.45	4.55
2	5.55	5.15	5.9	5.7	7.2	10.6	9.45	7.9	6.0	5.85	5.45	4.5
3	5.5	5.2	5.9	5.65	7.2	10.65	9.35	7.9	6.0	5.8	5.45	4.5
4	5.5	5.2	5.9	5.7	7.25	10.7	9.25	7.9	6.0	5.8	5.4	4.5
5	5.5	5.25	5.9	5.7	7.35	10.7	9.15	7.9	6.0	5.8	5.35	4.5
6	5.5	5.3	5.85	5.7	7.4	10.65	9.1	7.8	5.95	5.8	5.35	4.4
7	5.55	5.35	5.85	5.7	7.6	10.6	9.0	7.7	5.9	5.8	5.3	4.4
8	5.5	5.35	5.85	5.75	7.8	10.5	9.0	7.55	5.9	5.8	5.25	4.45
9	5.5	5.35	5.8	5.75	8.0	10.4	8.95	7.45	5.9	5.75	5.2	4.45
10	5.45	5.4	5.8	5.8	8.2	10.3	8.9	7.3	6.0	5.75	5.2	4.5
11	5.45	5.5	5.85	5.85	8.3	10.15	8.9	7.2	6.05	5.75	5.15	4.5
12	5.45	5.5	5.85	5.9	8.4	10.0	8.85	7.1	6.05	5.75	5.15	4.45
13	5.4	5.5	5.8	5.95	8.8	9.8	8.8	7.0	6.0	5.75	5.1	4.4
14	5.4	5.5	5.8	6.0	9.0	9.6	8.7	6.9	6.0	5.75	5.05	4.4
15	5.4	5.5	5.8	6.1	9.1	9.5	8.6	6.8	6.0	5.7	5.0	4.45
16	5.4	5.5	5.85	6.2	9.1	9.35	8.55	6.7	6.0	5.7	5.0	4.45
17	5.4	5.5	5.85	6.3	9.2	9.2	8.5	6.6	6.0	5.7	4.95	4.45
18	5.35	5.5	5.8	6.4	9.4	9.15	8.5	6.5	6.0	5.7	4.9	4.5
19	5.35	5.5	5.8	6.5	9.45	9.1	8.4	6.3	6.0	5.65	4.9	4.5
20	5.3	5.55	5.8	6.55	9.5	9.05	8.35	6.2	5.95	5.65	4.85	4.5
21	5.3	5.6	5.8	6.6	9.5	9.05	8.35	6.05	5.95	5.65	4.8	4.5
22	5.25	5.65	5.75	6.9	9.6	9.0	8.35	6.0	5.9	5.6	4.8	4.5
23	5.25	5.7	5.8	6.8	9.65	9.0	8.3	6.0	5.9	5.6	4.75	4.5
24	5.2	5.75	5.8	6.85	9.7	9.05	8.25	6.0	5.9	5.6	4.75	4.55
25	5.2	5.8	5.8	6.9	9.7	9.15	8.15	6.0	5.9	5.6	4.7	4.55
26	5.15	5.85	5.75	6.95	9.75	9.25	8.1	6.0	5.9	5.55	4.7	4.6
27	5.1	5.85	5.7	6.95	9.85	9.35	8.05	5.95	5.9	5.55	4.65	4.6
28	5.1	5.9	5.7	7.0	9.95	9.45	8.0	5.9	5.9	5.5	4.65	4.65
29	5.15	.....	5.7	7.0	10.0	9.5	7.95	6.0	5.9	5.5	4.6	4.7
30	5.15	.....	5.7	7.05	10.15	9.45	7.95	6.0	5.9	5.5	4.6	4.75
31	5.15	.....	5.7	.....	10.3	.....	7.95	5.95	.....	5.5	.....	4.75
1908.												
1	4.75	4.65	4.75	6.55	7.15	8.65	9.35	8.5	6.25	5.5	4.65	5.55
2	4.75	4.6	4.75	6.5	7.2	8.65	9.4	8.3	6.2	5.5	4.6	5.5
3	4.75	4.6	4.7	6.5	7.25	8.75	9.4	8.15	6.2	5.5	4.55	5.45
4	4.8	4.6	4.7	6.4	7.25	8.8	9.5	8.0	6.15	5.45	4.55	5.4
5	4.85	4.65	4.7	6.3	7.3	8.9	9.55	7.85	6.15	5.45	4.6	5.45
6	4.9	4.65	4.7	6.25	7.35	9.0	9.55	7.75	6.1	5.45	4.6	5.5
7	4.9	4.7	4.7	6.25	7.4	9.1	9.6	7.6	6.1	5.45	4.65	5.55
8	4.9	4.7	4.7	6.2	7.5	9.3	9.6	7.5	6.1	5.4	4.7	5.55
9	4.9	4.7	4.7	6.2	7.6	9.5	9.65	7.3	6.05	5.4	4.7	5.5
10	4.9	4.75	4.7	6.2	7.65	9.8	9.7	7.15	6.05	5.35	4.75	5.5
11	4.85	4.75	4.75	6.15	7.7	10.0	9.7	7.0	6.05	5.35	4.8	5.5
12	4.9	4.75	4.8	6.2	7.75	10.2	9.7	6.8	6.05	5.35	4.75	5.45
13	4.9	4.75	4.9	6.2	7.8	10.4	9.7	6.6	6.05	5.35	4.75	5.45
14	4.9	4.7	5.0	6.15	7.8	10.6	9.65	6.5	6.0	5.3	4.7	5.4
15	4.9	4.7	7.6	6.2	7.85	10.75	9.65	6.4	6.0	5.3	4.7	5.4
16	4.9	4.75	7.5	6.25	7.9	10.8	9.8	6.3	6.0	5.28	4.75	5.3
17	4.9	4.75	7.4	6.3	7.9	10.9	9.8	6.35	5.95	5.28	4.9	5.3
18	4.9	4.8	7.35	6.4	8.0	10.6	9.75	6.4	5.9	5.25	4.95	5.2
19	4.95	4.8	7.25	6.5	8.05	10.45	9.7	6.45	5.9	5.25	5.2	5.25
20	4.95	4.75	7.15	6.6	8.1	10.3	9.65	6.5	5.85	5.2	5.45	5.2
21	4.9	4.75	7.1	6.75	8.3	10.1	9.6	6.5	5.85	5.2	5.6	5.15
22	4.9	4.75	7.05	6.8	8.2	10.0	9.55	6.5	5.8	5.2	5.65	5.15
23	4.9	4.75	7.0	6.9	8.2	9.85	9.5	6.5	5.8	5.15	5.7	5.1
24	4.9	4.7	6.9	7.0	8.3	9.7	9.4	6.45	5.75	5.15	5.75	5.1
25	4.85	4.7	6.8	7.05	8.45	9.6	9.3	6.45	5.7	5.15	5.75	5.0
26	4.8	4.75	6.75	7.05	8.5	9.5	9.2	6.4	5.6	5.1	5.7	5.0
27	4.7	4.7	6.7	7.05	8.55	9.4	9.1	6.4	5.6	5.0	5.7	5.05
28	4.75	4.7	6.65	7.4	8.6	9.4	9.0	6.35	5.6	4.65	5.7	5.1
29	4.75	4.7	6.6	7.1	8.6	9.3	8.8	6.35	5.55	4.6	5.65	5.1
30	4.75	.....	6.5	7.1	8.6	9.3	8.7	6.3	5.55	4.6	5.6	5.15
31	4.75	.....	6.55	.....	8.6	.....	8.6	6.25	.....	4.65	.....	5.15

[a] The river was not frozen at the gage in 1907, but was frozen at still places in the river and lake, reaching a maximum thickness of 8 inches on the river and 12 inches on the lake. The ice formed January 1 and went out February 7, 1907.

Rating table for Chelan River at Chelan, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.40	370	5.70	1,020	7.00	2,480	8.60	5,310
4.50	405	5.80	1,090	7.10	2,630	8.80	5,690
4.60	440	5.90	1,170	7.20	2,780	9.00	6,070
4.70	480	6.00	1,260	7.30	2,940	9.20	6,450
4.80	520	6.10	1,360	7.40	3,100	9.40	6,830
4.90	565	6.20	1,460	7.50	3,270	9.60	7,210
5.00	610	6.30	1,570	7.60	3,450	9.80	7,600
5.10	660	6.40	1,680	7.70	3,630	10.00	8,000
5.20	710	6.50	1,800	7.80	3,810	10.20	8,400
5.30	765	6.60	1,920	7.90	3,990	10.40	8,800
5.40	820	6.70	2,050	8.00	4,170	10.60	9.200
5.50	880	6.80	2,190	8.20	4,550	10.80	9,600
5.60	950	6.90	2,330	8.40	4,930	11.00	10,000

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 11 discharge measurements made during 1903–1908, and is fairly well defined between gage heights 5.5 feet and 10.3 feet.

Monthly discharge of Chelan River at Chelan, Wash., for 1907 and 1908.

[Drainage area, 950 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	950	660	799	0.841	0.97	49.100	C.
February	1,170	685	888	.935	.97	49.300	C.
March	1,170	1,020	1,100	1.16	1.34	67,600	B.
April	2,560	985	1,610	1.69	1.89	95.800	B.
May	8,600	2,700	5,770	6.07	7.00	355,000	B.
June	9,400	6,070	7,540	7.94	8.86	449,000	B.
July	7,020	4,080	5,350	5.63	6.49	329,000	B.
August	3,990	1,170	2,320	2.44	2.81	143,000	B.
September	1,310	1,170	1,220	1.28	1.43	72,600	B.
October	1,170	1,880	1,010	1.06	1.22	62,100	B.
November	850	440	627	.660	.74	37,300	C.
December	500	370	411	.433	.50	25,300	C.
The year	9,400	370	2,390	2.51	34.22	1,740,000	
1908.							
January	588	480	544	.573	.66	33.400	C.
February	520	440	484	.509	.55	27.800	C.
March	3,450	480	1,600	1.68	1.94	98,400	B.
April	3,100	1,410	1,900	2.00	2.23	113,000	B.
May	5,310	2,700	4,040	4.25	4.90	248,000	B.
June	9,800	5,400	7,470	7.86	8.77	444,000	B.
July	7,600	5,310	6,940	7.31	8.43	427,000	B.
August	5,120	1,520	2,440	2.57	2.96	150,000	B.
September	1,520	915	1,210	1.27	1.42	72,000	B.
October	880	440	730	.768	.89	44,900	B.
November	1,060	422	677	.713	.80	40,300	B.
December	915	610	772	.813	.94	47,500	B.
The year	9,800	422	2,400	2.53	34.49	1,750,000	

WENATCHEE RIVER DRAINAGE BASIN.

WENATCHEE RIVER AT CASHMERE, WASH.

Wenatchee River rises in Cady Pass, at an elevation of 4,500 feet, flows southeastward, passing through Wenatchee Lake at an elevation of 1,870 feet and emptying into Columbia River at the town of Wenatchee.

With its tributaries it drains a stretch of the eastern slope of the Cascade Mountains about 40 miles long and the territory north of the Yakima River drainage basin, from which it is separated by the Wenatchee Mountains. The river has a number of tributaries, among which may be mentioned North Fork River, which flows into Wenatchee Lake near its head, and Chiwawa, Nason, Chumstick, Icicle, Peshastin, and Mission creeks. The upper part of the drainage area is heavily forested, but the lower part consists of timberless hills and ridges, in most places covered with sagebrush.

The mean annual precipitation at Wenatchee is 16 inches, a large part of it being in the form of snow. During portions of the winter the streams are icebound.

Irrigation has been extensively practiced in the lower portion of the area, but is confined to the valley lands contiguous to the streams. The Wenatchee Valley has become justly famous for its apples and other fruits, and lands for orchards are valued at $1,000 per acre and upward.

The gaging station, which was established July 26, 1904, is located at the upper highway bridge in Cashmere, one-half mile below the mouth of Mission Creek, and 8 miles above the mouth of the river.

The data obtained at this station are used in connection with the development of irrigation and water power. The Great Northern Railway has recently built a hydro-electric plant to run the trains through the Cascade tunnel by electric power.

The conditions at the station are not at all favorable for good results, and it is somewhat doubtful if the datum of the gage has been maintained absolutely since the station was established. During the summer of 1907 the highway bridge was rebuilt and the gage removed. A temporary gage was installed by the observer November 17, 1907. The observer reports that this temporary gage was 1 foot above the gage datum as determined by water levels. This temporary gage was destroyed March 16, 1908, and on April 7, 1908, the observer installed a temporary gage which was used until September 28, 1908, when a permanent gage was installed and the corrections for the temporary gage determined. The gage heights have been corrected to correspond with the original gage datum.

The lowest discharge on this stream occurs during the winter months, when the headwaters are icebound.

Owing to uncertainty regarding the accuracy of the gage heights, estimates of monthly discharge for 1907–8 are withheld until more information can be obtained.

The following measurement was made September 28, 1908: Width, 109 feet; area, 344 square feet; gage height, 0.90 foot; discharge, 665 second-feet.

Daily gage height, in feet, of Wenatchee River at Cashmere, Wash., for 1907 and 1908.

[A. C. Jones, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	2.1	1.6	3.1	2.5	4.7	8.0	4.8	3.1	1.8	.....	.....	2.9
2	.....	1.6	3.0	2.6	4.7	7.5	4.7	3.1	1.9	.....	.....	2.7
3	.....	1.6	3.0	2.7	5.1	7.0	4.6	3.1	2.2	.....	.....	2.7
4	.....	1.7	2.9	2.7	5.4	6.8	4.5	3.0	2.1	.....	.....	2.6
5	.....	1.7	2.9	2.7	5.7	6.8	4.4	2.9	2.0	.....	.....	2.5
6	1.9	1.7	2.8	2.8	6.1	6.6	4.4	2.7	1.9	.....	.....	2.5
7	1.9	1.8	2.8	2.8	6.5	6.3	4.3	2.5	1.8	.....	.....	2.5
8	1.8	2.45	2.8	2.8	6.7	5.9	4.2	2.4	1.8	.....	.....	2.5
9	1.8	3.3	2.8	3.1	6.6	5.6	4.2	2.4	1.8	.....	.....	2.4
10	1.7	3.9	2.8	3.8	6.4	5.4	4.3	2.0	2.0	.....	.....	2.4
11	1.7	3.6	2.8	3.9	6.4	5.4	4.4	2.1	2.0	.....	.....	2.4
12	1.7	3.5	2.7	3.9	6.0	5.4	4.3	2.1	2.1	.....	.....	2.4
13	1.7	3.4	2.7	4.0	5.8	5.1	4.2	2.0	2.0	.....	.....	2.4
14	1.7	3.3	2.7	4.5	5.7	4.8	3.9	1.9	1.5	.....	.....	2.4
15	1.7	3.1	3.7	4.4	6.3	4.7	3.9	1.9	1.6	.....	.....	2.3
16	1.6	3.0	2.7	4.5	7.2	4.5	3.8	1.9	2.0	.....	.....	2.2
17	1.6	3.0	2.6	4.5	7.5	4.4	3.8	1.8	2.0	.....	1.9	2.0
18	1.6	2.9	2.6	4.4	7.6	4.5	3.7	1.8	2.4	.....	1.9	1.9
19	1.6	2.8	2.5	4.4	7.7	5.0	3.7	1.8	2.2	.....	1.9	2.0
20	1.6	3.0	2.4	4.3	7.5	5.4	3.6	1.9	2.0	1.8	1.9	2.2
21	1.6	3.3	2.6	4.2	7.0	5.5	3.9	1.9	1.9	1.8	1.9	2.3
22	1.6	3.4	2.0	4.5	6.6	5.2	3.6	1.9	2.0	1.8	1.9	2.3
23	1.6	3.4	2.6	4.8	6.4	5.0	3.5	2.0	1.9	1.8	1.9	2.4
24	1.6	3.3	2.6	5.1	6.3	5.0	3.5	2.0	1.9	1.8	2.1	2.5
25	1.6	3.3	2.5	5.0	6.3	5.2	3.4	2.2	1.9	1.8	2.3	2.5
26	1.6	3.2	2.5	5.0	6.2	6.2	3.4	2.7	1.8	1.8	2.2	2.5
27	1.6	3.2	2.5	4.9	6.6	5.9	3.3	2.1	1.8	1.8	2.2	2.5
28	1.5	3.1	2.5	4.8	6.9	5.9	3.2	2.0	1.8	1.8	2.2	2.5
29	1.5	.....	2.5	4.6	7.2	5.4	3.1	1.9	.....	1.8	2.2	2.5
30	1.5	.....	2.4	4.6	7.4	4.9	3.0	1.9	.....	1.8	3.0	2.5
31	1.5	.....	2.5	.....	7.9	.....	3.1	1.8	.....	.....	.....	2.4
1908.[b]												
1	2.4	1.5	2.2	.....	4.5	5.2	5.7	3.7	.....	.....	.....	.....
2	2.3	1.5	2.2	.....	4.9	5.2	6.3	3.7	.....	.....	.....	.....
3	2.3	1.5	2.2	.....	5.0	5.2	6.6	3.5	.....	.....	.....	.....
4	2.2	1.5	2.2	.....	5.1	5.2	6.7	3.2	.....	.....	.....	.....
5	2.2	1.5	2.2	.....	5.1	5.3	6.6	3.2	.....	.....	.....	.....
6	2.2	1.6	2.2	.....	5.1	5.6	6.4	3.0	.....	.....	.....	.....
7	2.2	1.7	2.2	2.7	5.4	6.1	6.3	2.9	.....	.....	.....	.....
8	2.3	1.7	2.2	2.7	5.5	6.6	6.2	2.7	.....	.....	.....	.....
9	2.3	1.7	2.1	2.8	5.5	7.7	6.3	2.7	.....	.....	.....	.....
10	2.3	1.8	2.1	3.0	5.4	([c])	6.5	2.7	.....	.....	.....	.....
11	2.3	1.8	2.1	3.2	5.2	([c])	6.3	2.6	.....	.....	.....	.....
12	2.3	1.9	2.4	3.5	4.9	([c])	6.2	2.6	.....	.....	.....	.....
13	2.2	2.0	2.4	3.3	4.8	([c])	6.3	2.6	.....	.....	.....	.....
14	2.2	2.0	2.9	3.9	4.7	([c])	6.6	2.5	.....	.....	.....	.....
15	2.2	2.0	3.1	3.9	4.7	([c])	6.7	2.5	.....	.....	.....	.....
16	2.2	2.0	3.6	3.9	5.2	7.7	6.5	2.6	.....	.....	.....	.....
17	2.1	2.1	.....	4.0	5.0	7.1	6.4	2.6	.....	.....	.....	.....
18	2.1	2.1	.....	4.5	5.1	6.7	6.0	2.6	.....	.....	.....	.....
19	2.1	2.1	.....	5.2	5.4	5.9	5.7	2.6	.....	.....	.....	.....
20	2.2	2.1	.....	5.5	5.5	5.7	5.4	2.6	.....	.....	.....	.....
21	2.0	2.1	.....	5.5	5.4	5.6	5.3	2.7	.....	.....	.....	.....
22	2.1	2.0	.....	5.1	5.5	5.2	5.3	2.7	.....	.....	.....	.....
23	2.1	2.0	.....	4.9	5.5	4.9	5.2	2.5	.....	.....	.....	.....
24	2.0	2.0	.....	4.9	5.6	5.3	4.9	2.5	.....	.....	.....	.....
25	1.9	2.1	.....	4.9	5.8	4.7	4.7	2.5	.....	.....	.....	.....
26	1.8	2.1	.....	4.6	5.6	4.9	4.7	2.3	.....	.....	.....	.....
27	1.8	2.2	.....	4.4	5.6	5.3	4.4	2.1	.....	.....	.....	.....
28	1.8	2.2	.....	4.3	5.7	5.6	4.1	1.9	0.9	.....	.....	.....
29	1.7	2.2	.....	4.4	5.7	6.1	3.8	.....	.....	.....	.....	.....
30	1.7	.....	.....	4.5	5.6	5.7	3.7	.....	.....	.....	.....	.....
31	1.6	.....	.....	.....	5.3	.....	3.7	.....	.....	.....	.....	.....

[a] The river was partly frozen over January 1 to February 8; the ice reached a maximum thickness of 12 inches along the shore. The middle of the channel remained open and slush ice was running most of the time.

During the summer the highway bridge was built and the gage removed. A temporary gage was installed by the observer November 17. The observer reports that the temporary gage was 1 foot above gage datum as determined by water levels. Gage readings have been corrected.

[b] Gage readings January 1 to March 16 were taken from temporary gage installed November 17, 1907.

The gage was washed out March 16, and another temporary gage installed April 7, which was used until September 28, when a permanent gage was installed. All gage heights are liable to considerable error.

[c] Water over gage June 10-15, 1908.

MISCELLANEOUS MEASUREMENT.

A measurement of Mission Creek at the bridge one-fourth mile above the mouth near Cashmere, April 13, 1907, gave a discharge of 194 second-feet. Water surface was 3.05 feet below an 8d. nail in east face of cottonwood tree on left bank, 25 feet below the bridge.

YAKIMA RIVER DRAINAGE BASIN.

DESCRIPTION.

Yakima River rises in Keechelus Lake in the northwestern part of Kittitas County and flows southeastward for about 150 miles to its junction with the Columbia—8 miles northwest of Pasco and 4 miles above the mouth of Snake River. Its drainage area comprising 5,270 square miles, extends southward from the Wenatchee Mountains within 20 miles of Columbia River and includes a stretch of nearly 100 miles of the eastern slopes of the Cascade Range. It has many tributaries, the most important coming from the west, as is shown by the following table:

Principal tributaries of Yakima River.

From the south and west.	From the north and east.
Big Creek.	Kachess River (Kachess Lake).
Taneum Creek.	Clealum (Clealum Lake).
Man-as-tash Creek.	Teanaway Creek.
Wenas Creek.	Swauk Creek.
Naches River (draining about 50 miles of Cascade Range).	Kittitas Creek.
Tieton River.	Cherry Creek.
Cowiche Creek.	
Atanum Creek (forming northern boundary of Yakima Indian Reservation.	
Toppenish Creek (draining Yakima Indian Reservation).	
Satus Creek.	

The country at the headwaters of these streams is densely forested and very mountainous. The general elevation of the summit of that portion of the Cascade Mountains drained by them is 5,500 feet above sea level. Keechelus Lake is 2,458 feet above sea level, Kachess Lake is 2,230, Clealum Lake 2,130, Ellensburg 1,545, North Yakima 1,090, and Kiona 515 feet.

The agricultural lands of this basin lie in four distinct valleys. The upper one, which begins just below the mouth of Swauk Creek, is known as the Kittitas Valley. It is somewhat oval in shape, about 30 miles long by 16 miles wide. Ellensburg is its chief city. Below the valley the river flows in a narrow canyon, from which it emerges into Selah Valley. From Selah valley it passes through a narrow gap into Yakima and Moxee valleys. Below the Moxee Valley the river has cut its way through the Atanum and Rattlesnake ridges, forming a short narrow canyon known as Union Gap. Below Union

Gap the river flows to its mouth through a wide valley, unbroken except for the Toppenish Ridge, which lies south of the river approximately at right angles to its course.

The mean annual rainfall at Clealum is 28 inches, at Ellensburg 10 inches, at North Yakima 9 inches, and at Sunnyside 7 inches. The greater part of the precipitation occurs in the winter as snow. The snowfall near the summit of the Cascade Range frequently aggregates 25 or 30 feet in one season.

Irrigation has been practiced in this valley for many years, and ditches of all sizes—from the individual ditch watering a few acres on the banks of the creeks to large canals that extend for 60 miles and cover 40,000 or 50,000 acres of land—have been in successsful operation for a number of years. The products produced cover the entire range of irrigated agriculture, from hay and grain in the upper portion of the valley to the fancy fruits raised throughout the lower portions of the basin. Irrigated orchards in the vicinity of North Yakima have attained a value of $1,000 to $3,000 per acre. It is recognized that only through the development of storage can the fullest use of the waters be made. (See Pl. III, *B*, p. 36.)

The United States Reclamation Service has undertaken the general development of this valley. The principal storage reservoirs are found in Lakes Keechelus, Kachess, Clealum, and Bumping, and at McAllister Meadows on Tieton River. The development of the projects will be made in several units. The first was accomplished by the purchase of the Sunnyside Canal, which diverts water from the Yakima River below Union Gap. The second unit is the Tieton project, which diverts water from Tieton River for the benefit of land to the west of North Yakima. As Tieton River is the principal tributary of the Naches, whose natural flow has been entirely appropriated for irrigation through private enterprises, the water to be taken from the Tieton will be replaced by the release of water from the Bumping Lake reservoir. The third unit, on which work is progressing at present, is the Wapato project, which contemplates the enlargement and extension of two canals built by the United States Indian Service and the development of small storage reservoirs on the headwaters of Toppenish Creek. The lands to be irrigated are largely included in the Yakima Indian Reservation.

The intensive agriculture of this valley has rendered necessary the development of water powers. Several water-power plants are in successful operation, the largest being the plant of the Wapatox Company. Water is taken from Naches River in a long canal and used both for water power and irrigation.

Records of stream flow have been maintained in this valley since 1893. The year 1905 was the driest year since records have been obtained; 1903 was a wet year.

The following gaging stations have been maintained in this basin:

Yakima River near Martin (1903 to 1908).
Yakima River at Easton (1904).
Yakima River at Clealum (1906 to 1908).
Yakima River at Umtanum (1906 to 1908).
Yakima River at Selah Gap, near North Yakima (1897, 1898, 1904, and 1905).
Yakima River at Union Gap, near Yakima (1893 to 1908).
Yakima River near Wapato (1908).
Yakima River at Prosser (1904 to 1906).
Yakima River at Kiona (1895 to 1908).
Yakima River near Richland (1906 to 1908).
Kachess River near Easton (1903 to 1908).
North Fork of Clealum River at Galena (1907).
Clealum River near Roslyn (1903 to 1908).
Naches River near Nile (1904 to 1908).
Naches River at Tieton Gap (1905).
Naches River near North Yakima (1893 to 1908).
Bumping River near Nile (1906 and 1907).
Tieton River at McAllister Meadow, near Naches (1908).
Tieton River at headworks, near Natches (1906 to 1908).
Tieton River near Naches (1902 to 1908).
North Fork of Atanum Creek, near Tampico (1907 to 1908).
Atanum Creek at The Narrows, near Tampico (1908).
Atanum Creek near Yakima (1904 to 1908).
South Fork of Atanum Creek, near Tampico (1907 to 1908).
Toppenish Creek near Toppenish (1908).
Satus Creek near Alfalfa (1908).

In addition to the data collected at the river stations, records of the principal canals diverting water from the Yakima River and tributaries were kept during the irrigating season of 1904 and 1905. The following regular canal stations have been maintained:

New Reservation canal near Yakima (1904 to 1908).
Old Reservation canal near Wapato (1904 to 1908).
Sunnyside canal near Yakima (1904 to 1908).
Kiona canal near Kiona (1904, 1905, and 1908).

Lake gages have also been observed, as follows:

Lake Keechelus near Martin (1906 to 1908).
Lake Kachess near Easton (1905 to 1908).
Lake Clealum near Roslyn (1906 to 1908).

Records of evaporation have been obtained in Lake Kachess (1907 and 1908), and also in Sunnyside canal at Zillah (1907 and 1908).

LAKE KEECHELUS NEAR MARTIN, WASH.

A gage was established in Keechelus Lake January 12, 1906. It is located just above the outlet of the lake, 4 miles northeast of Martin, on the state road over Snoqualmie Pass.

The gage as originally established was 300 feet from the outlet of the lake at an arbitrary datum. When the dam at the outlet was completed in the winter of 1906–7, the gage was moved, and now

indicates the height above the sill of the outlet tunnels in the dam. All records have been corrected to this later datum, which is 2,457.00 feet above sea level.

Daily gage height, in feet, of Lake Keechelus near Martin, Wash., for 1907 and 1908.

[Christian Hansen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.72	3.68	4.60	3.09	7.46	11.97	11.27	11.15	7.91	6.66	3.56	7.63
2	4.72	3.62	4.56	3.09	7.51	11.78	11.26	11.14	7.74	6.72	3.60	7.86
3	4.36	3.56	4.37	2.74	7.55	11.55	11.26	11.12	7.55	6.80	3.55	7.91
4	4.02	3.52	4.22	2.42	7.76	11.47	11.33	11.12	7.35	6.88	3.48	7.86
5	3.68	3.84	4.12	2.45	8.12	11.34	11.25	11.10	7.16	6.92	3.46	7.84
6	3.44	4.10	4.07	2.49	8.60	11.26	11.19	11.10	6.95	7.00	3.44	7.72
7	3.41	4.31	4.00	2.49	9.18	11.21	11.14	11.12	6.75	7.08	3.43	7.62
8	3.58	5.05	3.94	2.50	9.90	11.26	11.11	11.14	6.56	7.15	3.38	7.45
9	3.76	5.52	3.91	2.62	10.48	11.38	11.04	11.14	6.33	7.15	3.32	7.28
10	3.92	5.17	3.80	3.12	10.90	11.47	11.03	11.14	6.14	6.98	3.30	7.14
11	4.08	4.69	3.69	3.18	11.16	11.56	11.14	11.14	5.86	6.84	3.24	7.04
12	4.24	4.24	3.64	3.26	11.18	11.60	11.21	11.14	5.65	6.69	3.20	6.96
13	4.42	3.77	3.62	3.38	11.18	11.55	11.24	11.13	5.50	6.50	3.16	6.91
14	4.48	3.56	3.57	3.90	11.17	11.47	11.28	11.14	5.37	6.23	3.16	6.78
15	4.58	3.76	3.51	4.00	11.34	11.38	11.30	11.12	5.29	5.99	3.14	6.61
16	4.67	4.06	3.50	4.05	11.62	11.30	11.30	11.10	5.26	5.74	3.12	6.42
17	4.75	4.37	3.43	5.96	12.11	11.26	11.28	11.05	5.43	5.52	3.15	6.21
18	4.91	4.67	3.41	6.04	12.06	11.50	11.28	10.85	5.55	5.30	3.14	6.06
19	4.81	4.53	3.38	6.28	12.09	11.66	11.27	10.65	5.72	5.10	3.16	5.86
20	4.64	4.54	3.36	6.46	11.98	11.58	11.26	10.45	5.82	4.91	3.26	5.74
21	4.60	4.54	3.32	6.51	11.81	11.53	11.25	10.25	5.90	4.74	3.36	5.76
22	4.64	4.55	3.29	6.59	11.62	11.51	11.24	10.05	6.00	4.56	3.68	5.82
23	4.12	4.57	3.25	6.82	11.55	11.50	11.23	9.85	6.08	4.40	4.02	6.04
24	3.64	4.54	3.21	7.01	11.52	11.47	11.22	9.66	6.16	4.26	4.52	6.70
25	3.57	4.56	3.19	7.09	11.48	11.45	11.20	9.46	6.23	4.11	4.98	7.09
26	3.54	4.60	3.14	7.12	11.56	11.39	11.20	9.24	6.28	3.98	5.41	7.36
27	3.54	4.62	3.11	7.21	11.60	11.37	11.18	9.01	6.36	3.86	5.57	7.44
28	3.56	4.62	3.14	7.34	11.70	11.35	11.17	8.79	6.44	3.72	5.68	7.44
29	3.55	.....	3.14	7.39	11.81	11.34	11.16	8.57	6.50	3.64	6.26	7.36
30	3.54	.....	3.13	7.41	11.88	11.30	11.15	8.34	6.58	3.56	7.32	7.33
31	3.64	.....	3.10	.....	11.98	.....	11.14	8.11	.....	3.64	.....	7.14
1908.												
1	7.03	3.88	3.40	10.89	12.32	12.00	11.97	11.32	6.14	1.31	4.00	8.65
2	6.90	3.82	3.40	10.78	12.42	11.98	11.97	11.30	6.12	1.29	4.40	8.84
3	6.72	3.75	3.39	10.68	12.42	11.91	11.93	11.29	6.09	1.24	4.45	8.94
4	6.54	3.74	3.42	10.62	12.38	11.88	11.89	11.24	6.05	1.20	4.65	9.07
5	6.48	3.83	3.61	10.53	12.36	11.86	11.86	11.01	6.02	1.18	4.80	9.16
6	6.39	3.82	3.74	10.46	12.36	11.90	11.86	10.64	6.00	1.16	5.00	9.26
7	6.26	3.74	3.84	10.32	12.45	12.05	11.93	10.02	6.00	1.14	5.10	9.36
8	6.14	3.66	3.94	10.22	12.67	12.40	11.96	9.86	5.96	1.12	5.20	9.46
9	6.05	3.62	4.04	10.12	12.48	12.66	11.96	9.77	5.94	1.12	5.30	9.58
10	5.90	3.59	4.16	10.07	12.30	12.76	11.92	9.48	5.74	1.12	5.40	9.67
11	5.80	3.59	4.36	10.05	12.19	12.74	11.92	9.34	5.55	1.10	5.40	9.76
12	5.68	3.54	4.62	10.42	12.06	12.62	11.90	9.26	5.37	1.10	5.40	9.98
13	5.54	3.50	5.29	10.84	11.88	12.47	11.93	9.16	5.19	1.14	5.35	10.30
14	5.42	3.50	7.15	11.26	11.79	12.47	11.86	9.03	4.66	1.28	5.30	10.48
15	5.27	3.50	8.69	11.50	11.86	12.50	11.84	8.88	3.79	1.64	5.30	10.60
16	5.20	3.48	11.32	11.67	11.94	12.31	11.97	8.76	3.62	2.04	5.40	10.68
17	5.12	3.48	12.05	11.94	11.92	12.18	11.87	8.62	3.45	2.10	5.60	10.75
18	5.00	3.47	11.96	12.51	11.96	12.09	11.81	8.35	3.10	2.10	6.22	10.81
19	4.94	3.43	11.75	12.87	12.03	11.96	11.77	8.12	2.85	2.10	6.56	10.88
20	4.88	3.40	11.56	12.97	12.09	11.89	11.71	7.85	2.55	2.20	6.78	10.99
21	4.78	3.38	11.40	12.75	12.10	11.83	11.67	7.63	2.36	2.20	6.92	11.08
22	4.68	3.36	11.25	12.45	12.04	11.79	11.63	7.38	2.18	2.20	7.02	11.15
23	4.56	3.33	11.31	12.33	11.94	11.76	11.59	7.12	1.98	2.30	7.10	11.21
24	4.47	3.32	11.44	12.31	12.08	11.70	11.56	6.84	1.78	2.40	7.22	11.30
25	4.38	3.32	11.47	12.40	12.20	11.92	11.51	6.62	1.65	2.50	7.34	11.37
26	4.30	3.43	11.40	12.29	12.10	12.04	11.46	6.35	1.53	2.60	7.58	11.43
27	4.25	3.42	11.27	12.22	12.09	12.11	11.41	6.17	1.46	2.60	7.80	11.60
28	4.18	3.42	11.18	12.18	12.06	12.06	11.38	6.08	1.40	2.70	7.98	11.60
29	4.12	3.41	11.12	12.14	12.09	11.99	11.36	6.13	1.37	2.90	8.21	11.52
30	4.04	.....	11.06	12.18	12.04	11.95	11.34	6.16	1.29	3.05	8.46	11.48
31	3.95	.....	10.96	.....	12.00	.....	11.34	6.14	.....	3.75	.....	11.46

Table showing volume of storage on Lake Keechelus near Martin, Wash., for 1906–1908.

Gage height.	Storage.	Gage height.	Storage.	Gage height.	Storage.	Gage height.	Storage.
Feet.	*Acre-feet.*	*Feet.*	*Acre-feet.*	*Feet.*	*Acre-feet.*	*Feet.*	*Acre-feet.*
0.00	0	4.00	5,688	8.00	11,580	12.00	17,690
1.00	1,403	5.00	7,140	9.00	13,090	13.00	19,250
2.00	2,818	6.00	8,610	10.00	14,610	14.00	20,820
3.00	4,246	7.00	10,090	11.00	16,140	15.00	22,400

NOTE.—This table has been used to determine the amount of water stored in or drawn from the lake, and, in connection with the records on Yakima River at Martin, to compute the inflow into the lake.

YAKIMA RIVER NEAR MARTIN, WASH.

This station was established October 18, 1903. It is located at the outlet of Lake Keechelus, 4 miles northwest of Martin station on the Northern Pacific Railway.

The data here obtained are used by the United States Reclamation Service in their general studies for the reclamation of lands in the Yakima River valley. Lake Keechelus is at present used as a storage reservoir. A temporary timber dam has been constructed, which will be replaced later by a permanent dam high enough to fully develop the storage capacity of this area.

The conditions at the station are favorable for obtaining good results. During the winter months, although the lake freezes, the flow at the station is under open-channel conditions on account of the rapid velocities which obtain here. The datum of the gage, which is 2,448.76 feet above sea level, has not been changed since it was installed, although a number of rating curves have been necessary. The flood of November 14, 1906, changed the channel somewhat, and later an attempt was made to improve channel conditions by shattering some of the larger bowlders above and below the station with dynamite.

Discharge measurements of Yakima River near Martin, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 2	H. D. McGlashan	112	205	7.02	249
May 29	do	120	381	8.70	1,150
June 12	Stevens and McGlashan	117	267	7.78	563
August 8	H. D. McGlashan	102	126	6.39	79
October 29	do	106	158	6.68	139
1908.					
July 18	Allen and Gleason	115	242	7.61	475
August 19	C. F. Gleason	111	189	7.16	309
November 16	L. R. Allen	103	127	6.46	105

Daily gage height, in feet, of Yakima River near Martin, Wash., for 1907 and 1908.

[Christian Hansen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	8.76	7.40	7.80	7.04	7.55	8.86	7.24	6.46	7.08	.....	6.64	7.37
2	8.29	7.39	7.80	7.06	7.55	8.68	7.22	6.46	7.04	.....	6.64	7.40
3	8.02	7.36	7.73	7.06	7.56	8.46	7.27	6.44	7.05	.....	6.62	7.42
4	7.85	7.32	7.70	7.08	7.62	8.40	7.31	6.44	7.12	.....	6.61	7.40
5	7.63	7.70	7.66	7.08	7.73	8.34	7.21	6.42	7.02	.....	6.60	7.40
6	7.28	7.68	7.62	7.09	7.92	8.26	7.14	6.33	7.11	.....	6.60	7.38
7	6.98	8.00	7.57	7.06	8.05	7.95	7.09	6.36	7.06	.....	6.59	7.38
8	.....	8.64	7.53	7.08	8.08	7.59	7.07	6.39	7.16	.....	6.58	7.36
9	.....	8.98	7.50	7.14	8.12	7.58	7.03	6.38	7.09	6.89	6.57	7.34
10	.....	8.78	7.44	7.15	8.16	7.66	6.70	6.38	7.01	6.91	6.56	7.32
11	.....	8.55	7.40	7.14	8.18	7.74	6.45	6.40	7.13	6.84	6.55	7.32
12	.....	8.40	7.40	7.22	8.19	7.78	6.57	6.40	7.04	6.86	6.54	7.30
13	.....	8.18	7.26	7.26	8.17	7.73	6.64	6.40	6.97	7.05	6.53	7.28
14	.....	7.70	7.29	7.68	8.17	7.66	6.65	6.40	6.86	7.15	6.53	7.26
15	.....	7.40	7.26	7.76	8.20	7.56	6.66	6.48	6.85	7.11	6.52	7.24
16	.....	.....	7.27	7.82	8.26	7.49	6.66	6.56	6.83	7.05	6.52	7.23
17	.....	.....	7.18	6.01	9.03	7.45	6.65	6.81	.....	7.04	6.52	7.22
18	.....	7.83	7.21	.....	8.96	7.49	6.64	6.93	.....	7.04	6.52	7.18
19	7.44	7.78	7.21	7.19	8.95	7.51	6.64	7.22	.....	7.00	6.53	7.16
20	7.54	7.76	7.20	7.29	8.80	7.49	6.62	7.07	.....	6.93	6.56	7.10
21	7.73	7.77	7.18	7.28	8.64	7.47	6.60	7.00	.....	6.89	6.58	7.11
22	8.30	7.76	7.16	7.34	8.52	7.45	6.58	7.04	.....	6.86	6.66	7.13
23	8.38	7.79	7.15	7.45	8.45	7.42	6.56	7.09	.....	6.84	6.76	7.20
24	7.72	7.78	7.15	7.54	8.40	7.40	6.54	7.03	.....	6.80	6.88	7.29
25	7.31	7.78	7.13	7.57	8.34	7.37	6.53	7.23	.....	6.78	6.98	7.36
26	7.28	7.82	7.12	7.54	8.46	7.34	6.50	7.14	.....	6.74	7.07	7.40
27	7.30	7.82	7.08	7.54	8.51	7.31	6.48	7.08	.....	6.72	7.10	7.40
28	7.36	7.86	7.09	7.55	8.62	7.27	6.47	7.12	.....	6.69	7.12	7.40
29	7.35	.....	7.08	7.57	8.71	7.25	6.46	7.20	.....	6.66	7.25	7.40
30	7.35	.....	7.06	7.55	8.76	7.24	6.45	7.22	.....	6.64	7.34	7.39
31	7.39	.....	7.05	.....	8.84	.....	6.44	7.15	.....	6.64	.....	7.36
1908.[b]												
1	7.34	6.72	6.62	7.25	7.80	7.99	7.87	6.76	6.44	6.44	6.79	.....
2	7.32	6.71	6.62	7.23	8.14	7.94	7.94	6.74	6.44	6.43	6.88	.....
3	7.30	6.70	6.61	7.22	8.06	7.87	7.99	6.71	6.45	6.40	6.64	.....
4	7.28	6.70	6.61	7.21	8.06	7.79	7.95	7.10	6.46	6.38	6.35	.....
5	7.27	6.71	.....	7.20	7.94	7.76	7.87	7.35	6.44	6.37	6.30	.....
6	7.26	6.71	.....	7.18	7.94	7.84	7.83	7.75	6.44	6.36	6.30	.....
7	7.25	6.70	.....	7.16	8.15	8.12	7.89	7.85	6.45	6.35	6.32	.....
8	7.24	6.69	.....	7.14	8.52	8.74	7.91	7.28	6.43	6.34	6.30	.....
9	7.22	6.68	.....	7.12	8.26	9.19	7.89	6.89	7.04	6.33	6.30	.....
10	7.20	6.66	.....	7.12	8.06	9.33	7.80	6.90	7.04	6.32	6.38	.....
11	7.16	6.66	.....	7.11	7.99	9.36	7.80	6.90	7.02	6.31	6.48	.....
12	7.14	6.65	.....	.....	7.90	9.56	7.79	6.90	7.02	6.30	6.50	.....
13	7.10	6.64	.....	.....	7.72	8.79	7.81	6.90	7.01	6.32	6.40	.....
14	7.08	6.64	6.52	6.52	7.61	8.78	7.73	6.90	7.40	6.39	6.40	.....
15	7.06	6.64	6.94	6.90	7.72	8.82	7.65	6.90	7.55	6.43	6.40	.....
16	7.04	6.64	7.70	7.12	7.90	8.53	7.96	6.90	7.38	6.48	6.46	.....
17	7.02	6.64	8.48	7.46	7.88	8.27	7.77	6.90	7.25	6.50	6.54	.....
18	7.00	6.64	8.40	8.21	7.92	8.18	7.60	7.22	7.05	6.50	6.90	.....
19	7.00	6.63	8.12	8.58	8.04	8.11	7.54	7.16	6.92	6.52	7.04	.....
20	6.98	6.63	7.94	9.06	8.05	8.02	7.50	7.19	6.85	6.54	7.12	.....
21	6.96	6.62	7.72	8.71	7.99	8.01	7.42	7.17	6.81	6.40	7.17	.....
22	6.93	6.62	7.57	8.25	7.94	7.97	7.34	7.19	6.79	6.25	7.21	.....
23	6.90	6.61	7.63	7.96	7.95	7.89	7.26	7.18	6.71	6.25	7.20	.....
24	6.86	6.61	7.78	7.82	8.15	7.83	7.19	7.18	6.67	6.25	.....	.....
25	6.84	6.61	7.82	7.96	8.42	7.95	7.08	7.18	6.61	6.25	.....	6.45
26	6.83	6.64	7.72	7.78	8.31	8.09	6.99	7.13	6.57	6.25	.....	6.58
27	6.82	6.63	7.59	7.70	8.13	8.16	6.94	7.04	6.54	6.25	.....	6.82
28	6.80	6.63	7.50	7.64	8.11	8.10	6.85	6.82	6.50	6.25	.....	7.14
29	6.80	6.63	7.44	7.56	8.16	7.88	6.81	6.49	6.47	6.25	.....	7.10
30	6.78	.....	7.38	7.60	8.09	7.81	6.79	6.44	6.44	6.32	.....	6.98
31	6.74	.....	7.30	.....	8.02	.....	6.78	6.44	.....	6.67	.....	6.88

[a] Outflow from lake was shut off January 8 to 18, while gravel and bowlders were being taken from bed of stream near gaging section for a crib dam then under construction at lake outlet.

While dam was under construction, January 19 to April 16, water was shut off during the day and allowed to run nights, Sundays, and some other periods when it was impossible to work.

Water was shut off from September 17 to 10 a. m. October 9.

[b] Flow shut off at lake on days when gage height is not given.

Rating tables for Yakima River near Martin, Wash.

JANUARY 19 TO DECEMBER 31, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	63	7.80	567
6.40	80	7.90	618
6.50	99	8.00	672
6.60	120	8.10	728
6.70	146	8.20	788
6.80	173	8.30	853
6.90	203	8.40	922
7.00	234	8.50	993
7.10	268	8.60	1,068
7.20	306	8.70	1,144
7.30	344	8.80	1,221
7.40	386	8.90	1,299
7.50	430	9.00	1,378
7.60	474	9.10	1,458
7.70	520		

1908.[b]

6.20	62	6.90	215
6.30	76	7.00	245
6.40	93	7.10	277
6.50	112	7.20	312
6.60	134	7.30	350
6.70	158	7.40	390
6.80	186	7.50	430

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on five discharge measurements made during 1907 and is well defined between gage heights 6.4 feet and 8.7 feet. The 1906 rating table is used from January 1 to 7.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on three discharge measurements made during 1908 and the higher 1907 measurements, and is well defined between gage heights 6.4 feet and 8.7 feet. Above gage height 7.5 feet the table is the same as for 1907.

Monthly discharge of Yakima River near Martin, Wash., for 1906 to 1908.

[Drainage area, 56 square miles.]

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Natural.	Mean.	Mean, per sq. mile.		
1906.										
January	492	134	250	15,400	+ 1,360	16,800	273	4.88	5.63	A.
February	357	185	255	14,200	− 340	13,900	250	4.46	4.64	A.
March	263	161	200	12,300	− 29	12,300	200	3.57	4.12	A.
April	968	326	581	34,600	+ 2,080	36,700	616	11.00	12.27	A.
May	1,000	438	682	41,900	− 715	41,200	670	11.96	13.79	A.
June	565	306	416	24,800	− 1,000	23,800	400	7.14	7.97	A.
July	302	86	177	10,900	− 1,380	9,520	155	2.77	3.19	A.
August	83	56	67.3	4,140	− 603	3,540	57.5	1.03	1.19	A.
September	86	52	68.9	4,100	+ 56	4,160	69.9	1.25	1.40	A.
October	565	83	265	16,300	+ 2,720	19,000	309	5.52	6.36	A.
November	6,150	0	979	58,300	+ 1,080	59,400	999	17.84	19.90	B.
December	770	0	272	16,700	+ 4,520	21,200	346	6.18	7.12	A.
The year	6,150	0	351	254,000	+ 7,730	262,000	362	6.46	87.58	
1907.										
January[a]	968	0	249	15,300	− 3,770	11,500	187	3.34	3.85	A.
February[a]	1,360	0	490	27,200	+ 1,420	28,600	515	9.20	9.58	A.
March[a]	567	149	360	22,100	− 2,200	19,900	324	5.79	6.68	A.
April[a]	577	0	267	15,900	+ 6,310	22,200	373	6.66	7.43	A.
May	1,400	452	886	54,500	+ 6,960	61,500	1,000	17.86	20.59	A.
June	1,270	321	548	32,600	− 1,050	31,500	529	9.45	10.54	A.
July	348	88	168	10,300	− 242	10,100	164	2.93	3.38	A.

[a] The daily discharges for January 19 to April 16, while dam was under construction, were obtained by distributing the flow while the gates were open over the entire twenty-four hours. The rating table for 1907 was used.

Monthly discharge of Yakima River near Martin, Wash., for 1906 to 1908—Continued.

Month.	Observed discharge in second-feet.			Run-off in acre feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Natural.	Mean.	Mean, per sq. mile.		
1907.										
August	317	68	172	10,600	− 4,610	5,990	97.4	1.74	2.01	B.
September	291	0	130	7,740	− 2,280	5,460	89.1	1.59	1.77	B.
October	287	0	144	8,850	− 4,300	4,550	74.0	1.32	1.52	A.
November	361	103	153	9,100	+ 5,400	14,500	244	4.36	4.86	A.
December	395	268	348	21,400	− 268	21,100	343	6.12	7.06	A.
The year	1,400	0	326	236,000	+ 1,360	237,000	328	5.86	79.27	
1908.										
January	366	169	265	16,300	− 4,680	11,600	189	3.38	3.90	A.
February	164	136	147	8,460	− 780	7,680	134	2.39	2.58	A.
March	979	0	319	19,600	+12,800	32,400	527	9.41	10.85	A.
April	1,430	0	466	27,700	+ 343	28,000	470	8.39	9.36	A.
May	1,010	479	695	42,700	− 281	42,400	690	12.32	14.20	A.
June	1,860	548	884	52,600	− 68	52,500	882	15.75	17.58	A.
July	667	180	463	28,500	− 955	27,500	447	7.98	9.20	A.
August	592	101	261	16,000	− 7,850	8,150	133	2.38	2.74	A.
September	452	99	190	11,300	− 7,000	4,300	72.2	1.29	1.44	B.
October	151	69	88.7	5,460	+ 3,510	8,960	146	2.61	3.01	B.
November	316	0	117	6,960	+ 6,950	13,900	234	4.18	4.67	B.
December	291	0	46.5	2,860	+ 4,580	7,440	121	2.16	2.49	A.
The year	1,860	0	329	238,000	+ 6,550	245,000	337	6.02	82.02	

NOTE.—The amount of water stored has been computed from the gage height and storage table for Lake Keechelus. The "natural" run-off in acre-feet and mean discharge represent the flow into the lake, less evaporation, or the run-off and discharge that would have occurred had the lake been held at a constant level.

YAKIMA RIVER AT CLEALUM, WASH.

This station, which was established August 25, 1906, for the purpose of determining the most economic method of operating the storage reservoirs contemplated and under construction on the headwaters of Yakima River by the United States Reclamation Service, is located just above the town of Clealum, 6 miles above the mouth of Teanaway River, and 3 miles below the mouth of Clealum River. The flow obtained here is taken in conjunction with that at Umtanum and Union Gap in the distribution of stored waters.

The flood of November, 1906, partly destroyed the bridge and the gage equipment. The datum was maintained, although the channel conditions were so altered that another rating was required. Since that date the conditions have been more favorable for good results than they were before, and the data are reliable. Ice conditions, which obtain for a short period during the winter months, affect to a small degree the accuracy of the data. At such times, and where other means fail, the data are usually supplied by interpolation.

Discharge measurements of Yakima River at Clealum, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 25	W. C. Muldrow	210	927	3.90	2,260
March 9	do	208	822	3.38	1,520
March 27	H. D. McGlashan	203	680	2.75	1,030
May 1	do	219	1,090	4.66	3,500
May 30	do	236	1,470	6.35	7,480
June 13	Stevens and McGlashan	216	984	4.28	2,760
August 9	H. D. McGlashan	195	503	2.08	570
October 30	do	192	449	1.65	375
1908.					
May 5	H. D. McGlashan	220	1,180	5.28	5,000
June 22	J. C. Stevens	217	971	4.46	2,960
July 19 [a]	L. R. Allen	225	964	4.30	2,800
August 18	C. F. Gleason	200	583	2.73	1,060
November 17 [a]	L. R. Allen	192	437	1.88	435

[a] Made with defective meter; discarded.

Daily gage height, in feet, of Yakima River at Clealum, Wash., for 1907 and 1908.

[T. J. Denny, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907. [a]												
1	2.98	2.68	3.62	2.82	4.60	6.52	3.80	2.12	2.40	1.75	1.65	3.18
2	3.42	2.65	3.58	2.75	4.70	6.18	3.65	2.15	2.32	1.75	1.72	3.18
3	3.30	2.32	3.50	2.78	4.95	5.90	3.60	2.18	2.32	1.85	1.70	3.15
4	3.30	2.52	3.55	2.80	5.15	5.68	3.60	2.08	2.32	1.90	1.72	3.15
5	3.25	2.28	3.35	2.90	5.48	5.62	3.58	2.10	2.35	1.80	1.65	3.15
6	3.05	2.62	3.30	3.02	6.00	5.50	3.48	2.08	2.30	1.82	1.70	3.10
7	2.85	3.25	3.28	3.12	6.05	5.35	3.40	2.15	2.30	1.80	1.65	3.02
8	2.75	3.62	3.25	3.05	6.15	4.98	3.28	2.12	2.30	1.75	1.72	2.98
9	2.60	4.50	3.22	3.18	6.30	4.88	3.20	2.08	2.30	1.75	1.72	2.92
10	2.55	4.82	3.25	3.50	6.15	4.68	3.20	2.08	2.30	1.72	1.70	2.90
11	2.50	4.78	3.32	3.60	6.08	4.55	3.15	2.05	2.28	1.95	1.70	2.90
12	2.42	4.52	3.18	3.80	5.85	4.52	3.08	2.00	2.32	1.95	1.68	2.88
13	2.40	4.38	3.18	3.90	5.60	4.28	3.05	1.72	2.28	1.92	1.58	2.95
14	2.42	4.12	3.12	4.12	5.58	4.05	2.95	1.95	2.22	2.00	1.58	2.92
15	2.32	3.72	3.25	4.25	5.85	3.78	2.90	1.92	2.22	2.02	1.62	2.80
16	2.50	3.50	3.08	4.42	6.55	3.70	2.82	1.95	2.20	2.02	1.55	2.80
17	2.32	3.35	3.00	4.42	6.88	3.62	2.80	2.00	2.10	2.02	1.58	2.70
18	2.48	3.30	2.95	4.30	6.85	3.55	2.75	2.25	1.95	1.98	1.62	2.68
19	2.45	3.45	2.92	4.20	6.75	3.72	2.65	2.42	1.95	1.92	1.58	2.60
20	2.50	3.65	2.92	4.20	6.65	3.95	2.60	2.42	1.95	1.90	1.80	2.60
21	3.00	3.70	2.92	4.18	6.38	4.02	2.60	2.40	1.98	1.92	1.82	2.65
22	3.02	3.70	2.85	4.40	6.08	3.95	2.58	2.38	1.90	1.82	1.98	2.70
23	3.15	3.70	2.85	4.72	5.95	3.78	2.48	2.35	1.90	1.80	2.02	2.90
24	3.32	3.75	2.78	4.92	5.90	3.70	2.38	2.38	1.90	1.80	2.35	3.25
25	2.95	3.90	2.75	4.92	5.82	3.75	2.32	2.42	1.88	1.80	2.65	3.28
26	2.90	3.75	2.68	4.90	5.80	3.88	2.30	2.42	1.85	1.72	2.72	3.30
27	2.70	3.70	2.70	4.90	5.92	4.02	2.20	2.40	1.82	1.65	2.55	3.20
28	2.60	3.68	2.68	4.72	6.05	4.10	2.20	2.40	1.78	1.70	2.58	3.18
29	2.65	.....	2.68	4.60	6.20	4.02	2.20	2.38	1.78	1.68	2.70	3.15
30	2.68	.....	2.72	4.55	6.30	3.90	2.08	2.40	1.75	1.65	2.98	3.12
31	2.72	.....	2.70	.....	6.45	.....	2.12	2.40	.....	1.62	.....	3.02
1908. [b]												
1	2.95	2.15	2.12	3.75	4.99	5.00	5.08	2.88	2.92	1.92	2.18	2.40
2	2.95	2.25	2.12	3.67	5.29	4.98	5.45	2.85	2.90	1.95	2.32	2.32
3	2.89	2.27	2.09	3.67	5.45	4.98	5.60	2.85	2.98	1.90	2.22	2.25
4	2.85	2.12	2.09	3.62	5.35	4.92	5.35	2.78	2.92	1.88	2.10	2.18
5	2.79	2.17	2.05	3.55	5.25	5.00	4.90	2.90	2.88	1.88	1.88	2.12
6	2.77	2.12	1.93	3.55	([c])	5.15	4.70	3.00	2.78	1.90	1.78	2.12
7	2.77	2.02	1.85	3.47	([c])	5.40	4.65	3.08	2.70	1.82	1.68	2.08
8	2.72	2.05	1.85	3.45	5.75	5.98	4.65	3.12	1.98	1.60	1.75	2.08
9	2.69	2.07	1.87	3.49	5.60	6.68	4.58	2.92	2.00	2.08	1.65	2.05
10	2.67	2.05	1.87	3.59	5.32	7.00	4.68	2.80	2.18	2.12	1.70	2.00

[a] There was some slush ice in the river January 1 to 12; river frozen January 12 to 20, average thickness of ice about 4 inches.

[b] The river was clear of ice throughout the year except a little shore ice January 31 and February 1.

[c] Gage chain broken. No reading made.

Daily gage height, in feet, of Yakima River at Clealum, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908												
11	2.67	2.05	1.99	3.67	5.12	7.12	4.72	2.78	2.28	2.08	1.68	2.00
12	2.67	2.02	2.27	3.85	4.92	7.05	4.70	2.72	2.30	2.15	1.88	2.08
13	2.62	2.02	3.02	4.19	4.78	6.65	4.72	2.75	2.32	2.10	1.88	2.15
14	2.59	2.05	4.37	4.42	4.68	6.42	4.68	2.75	2.52	1.98	1.85	2.22
15	2.55	1.99	4.55	4.55	4.82	6.40	4.65	2.62	2.65	2.05	1.85	2.20
16	2.55	2.07	5.49	4.45	5.12	6.30	4.92	2.62	2.72	2.05	1.78	2.20
17	2.49	2.07	4.99	4.67	5.08	5.75	4.98	2.65	2.62	1.92	1.85	2.15
18	2.47	2.07	5.19	5.17	5.08	5.32	4.60	2.65	2.52	1.92	2.05	2.08
19	2.42	2.07	5.02	5.77	5.25	5.08	4.35	2.80	2.50	1.65	2.25	2.02
20	2.39	2.05	4.75	6.19	5.22	4.90	4.20	2.75	2.40	1.65	2.35	2.00
21	2.39	2.02	4.57	6.29	5.20	4.55	4.00	2.78	2.32	1.65	2.85	1.92
22	2.29	1.99	4.35	5.89	5.12	4.38	3.90	2.75	2.22	1.62	3.18	1.95
23	2.32	1.97	4.39	5.57	5.18	4.30	3.80	2.78	2.18	1.52	3.30	1.95
24	2.27	1.99	4.67	5.39	5.34	4.35	3.70	2.72	2.12	1.50	3.30	2.08
25	2.27	2.02	4.67	5.32	5.70	4.68	3.62	2.75	2.08	1.48	3.02	2.18
26	2.27	2.07	4.52	5.07	5.72	4.98	3.50	2.70	2.05	1.40	2.82	2.42
27	2.19	2.12	4.35	4.89	5.48	5.05	3.28	2.60	2.05	1.45	2.65	2.58
28	2.19	2.07	4.17	4.79	5.35	4.92	3.15	2.92	2.00	1.42	2.55	2.70
29	2.12	2.12	4.05	4.69	5.25	4.75	3.00	3.15	1.98	1.50	2.50	2.72
30	2.12	.....	3.97	4.72	5.20	4.78	2.95	3.08	1.82	1.78	2.45	2.60
31	2.12	.....	3.87	.....	4.95	.....	2.90	2.98	.....	1.92	.....	2.52

Rating table for Yakima River at Clealum, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	280	2.60	910	3.80	2,065	5.00	4,190
1.50	315	2.70	985	3.90	2,190	5.20	4,650
1.60	350	2.80	1,060	4.00	2,330	5.40	5,125
1.70	385	2.90	1,140	4.10	2,480	5.60	5,615
1.80	430	3.00	1,225	4.20	2,635	5.80	6,110
1.90	475	3.10	1,315	4.30	2,800	6.00	6,620
2.00	525	3.20	1,415	4.40	2,975	6.20	7,130
2.10	580	3.30	1,515	4.50	3,150	6.40	7,640
2.20	640	3.40	1,615	4.60	3,350	6.60	8,150
2.30	700	3.50	1,720	4.70	3,550	6.80	8,660
2.40	765	3.60	1,830	4.80	3,750	7.00	9,170
2.50	835	3.70	1,945	4.90	3,965	7.20	9,690

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1907-8 and is well defined.

Monthly discharge of Yakima River at Clealum, Wash., for 1906 to 1908.

[Drainage area, 500 square miles.]

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Natural.	Mean.	Mean per square mile.		
1906.										
August 24-30	505	472	501	7,950	.....	.....	.....	.....	.....	
September	505	440	484	28,800	− 2,490	26,300	442	0.884	0.99	A.
October	6,620	472	1,420	87,300	+13,000	100,000	1,630	3.26	3.76	A.
November	[a]25,600	981	[b]5,580	332,000	+ 5,200	337,000	[b]5,660	11.3	12.61	B.
December	.....	.....	[b]1,400	86,000	− 3,630	82,400	[b]1,340	2.68	3.09	B.

[a] Estimated.
[b] Mean natural discharge November and December has been taken as 25 per cent greater than combined natural discharge at Martin, Easton, and Roslyn stations and the actual flow at the station computed from these values. Gage heights published for November 29 to December 30 were probably very much in error.

Monthly discharge of Yakima River at Clealum, Wash., for 1906 to 1908—Continued.

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Natural.	Mean.	Mean per square mile.		
1907.										
January	1,640	713	1,060	65,200	− 5,620	59,600	969	1.94	2.24	A.
February	3,790	688	1,920	107,000	+ 4,160	111,000	2,000	4.00	4.16	A.
March	1,850	970	1,310	80,600	− 7,250	73,400	1,190	2.38	2.74	A.
April	4,010	1,020	2,430	145,000	+17,900	163,000	2,740	5.48	6.11	A.
May	8,860	3,350	6,570	404,000	+16,500	420,000	6,830	13.7	15.79	A.
June	7,950	1,780	3,350	199,000	− 396	199,000	3,340	6.68	7.45	A.
July	2,060	569	1,170	71,900	− 2,970	68,900	1,120	2.24	2.58	A.
August	779	394	644	39,600	−10,100	29,500	480	.960	1.11	A.
September	765	408	593	35,300	− 9,720	25,600	430	.860	.96	A.
October	536	357	445	27,400	−11,400	16,000	260	.520	.60	A.
November	1,210	332	519	30,900	+11,400	42,300	711	1.42	1.58	A.
December	1,520	910	1,220	75,000	+ 2,130	77,100	1,250	2.50	2.88	A.
The year	8,860	332	1,770	1,280,000	+ 4,530	1,290,000	1,780	3.56	48.20	
1908.										
January	1,180	592	858	52,800	−10,900	41,900	681	1.36	1.57	A.
February	682	510	565	32,500	− 1,130	31,400	546	1.09	1.18	A.
March	5,350	452	2,180	134,000	+40,500	174,000	2,830	5.66	6.52	A.
April	7,360	1,670	3,460	206,000	+ 4,170	210,000	3,530	7.06	7.88	A.
May	5,980	3,510	4,760	293,000	+ 8,690	302,000	4,910	9.82	11.32	A.
June	9,480	2,800	5,290	315,000	+ 542	316,000	5,310	10.6	11.83	A.
July	5,620	1,140	3,050	188,000	− 4,080	184,000	2,990	5.98	6.89	A.
August	1,360	910	1,080	66,400	−21,200	45,200	735	1.47	1.70	A.
September	1,210	439	783	46,600	−23,000	23,600	397	.794	.89	A.
October	610	280	441	27,100	+ 1,570	28,700	467	.934	1.08	A.
November	1,520	368	712	42,400	+23,000	65,400	1,100	2.20	2.46	A.
December	1,000	485	650	40,000	+ 3,390	43,400	706	1.41	1.63	A.
The year	9,480	280	1,990	1,440,000	+21,600	1,470,000	2,020	4.03	54.95	

NOTE.—The amount of stored water at this station is the sum for Lakes Keechelus, Kachess, and Clealum.

YAKIMA RIVER AT UMTANUM, WASH.

This station, which was established August 25, 1906, is located at Umtanum Siding, in the canyon of Yakima River between the Selah and Kittitas valleys, 1 mile above the mouth of Umtanum Creek. The station has great value in the general scheme of reclamation undertaken by the United States Reclamation Service, for the records indicate the amount of water available from Yakima River for the Selah and Moxee valleys, and show also the amount passing the Kittitas Valley after all seepage waters from irrigation are returned to the river. The records are also extensively used during the irrigating season at this point in conjunction with those at Clealum and Union Gap in studying the most economic method of operating storage reservoirs which are contemplated and under construction for the irrigation of the valley.

The conditions at this station are favorable for good results and the data obtained are reliable. A riffle control is located about 100 yards below the gaging section, and although high floods will change the cross section at the point of measurement these changes are counterbalanced by corresponding changes in velocity; thus the gage

height is always a stable index of the flow. The estimates during the winter months are rendered somewhat uncertain by ice conditions, but as these conditions do not prevail for very long periods and do not occur at critical stages the errors due to this cause are not great.

Discharge measurements of Yakima River at Umtanum, Wash., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1906.					
August 25	J. C. Stevens	230	414	3.07	365
1907.					
March 11	W. C. Muldrow	245	1,120	5.23	3,020
March 28	H. D. McGlashan	242	968	4.58	1,970
May 2	do	244	1,320	6.11	5,080
May 31	do	251	1,580	7.10	8,170
August 10	do	232	626	3.22	466
1908.					
May 6	H. D. McGlashan	256	1,380	6.19	5,680
June 22	J. C. Stevens	244	1,170	5.30	3,430
August 21	C. F. Gleason	237	726	3.64	860
November 14	L. R. Allen	232	650	3.37	541

Daily gage height, in feet, of Yakima River at Umtanum, Wash., for 1907 and 1908.

[Joseph B. Freeman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.26	5.02	5.70	4.58	6.05				3.54	3.23	3.23	4.34
2	4.58	4.98	5.55	4.60	6.03				3.62	3.22	3.26	4.34
3	4.64	4.92	5.41	4.68	6.21				3.58	3.21	3.29	4.30
4	4.56	4.75	5.36	4.50	6.60				3.53	3.24	3.29	4.30
5	4.62	4.81	5.26	4.38	7.03				3.52	3.25	3.28	4.29
6	4.54	4.72	5.31	4.40	7.00				3.61	3.25	3.28	4.24
7	4.42	5.35	5.17	4.68	7.30				3.57	3.25	3.27	4.19
8	4.19	5.32	5.18	4.70	7.19				3.57	3.23	3.29	4.17
9	4.02	5.62	5.25	4.68	7.00				3.53	3.22	3.30	4.11
10	3.98	6.18	5.28	4.83	7.35			3.24	3.51	3.21	3.30	4.10
11	3.95	6.17	5.29	5.61	7.45			3.26	3.49	3.24	3.29	4.10
12	4.03	5.99	5.15	5.71	7.26			3.27	3.53	3.29	3.29	4.11
13	3.95	5.78	5.05	5.81	7.30			3.20	3.54	3.31	3.26	4.15
14	3.95	5.62	4.98	6.15	6.60			3.15	3.56	3.37	3.26	4.17
15	3.86	5.37	5.02	6.35	6.35			3.12	3.55	3.43	3.26	4.09
16	3.92	5.19	5.44	6.42	7.78			3.11	3.56	3.44	3.26	4.02
17	5.21	5.04	4.85	6.45	7.90			3.11	3.52	3.44	3.26	4.00
18	6.17	5.88	4.84	6.20	7.83			3.13	3.49	3.41	3.26	3.96
19	(a)	5.70	4.82	6.06	7.78			3.22	3.45	3.40	3.26	3.91
20	(a)	5.55	4.84	5.98	7.93			3.45	3.43	3.38	3.26	3.88
21	(a)	(b)	4.78	6.08				3.54	3.37	3.35	3.29	3.90
22	(a)	(b)	4.72	6.05				3.52	3.35	3.34	3.35	3.90
23	(a)	(b)	4.72	6.33				3.44	3.32	3.33	3.45	4.10
24	6.14	(b)	4.68	6.35				3.40	3.29	3.32	3.56	4.32
25	5.50	(b)	4.62	6.93				3.42	3.28	3.31	3.79	4.48
26	5.20	(b)	4.62	7.03				3.50	3.28	3.29	3.93	4.49
27	5.22	(b)	4.60	6.65				3.50	3.27	3.28	3.98	4.42
28	5.20	5.88	4.55	6.22				3.50	3.25	3.28	3.90	4.40
29	5.12		4.54	6.15				3.48	3.25	3.29	3.89	4.18
30	5.02		4.50	6.04				3.49	3.23	3.28	4.08	4.20
31	5.08		4.49					3.51		3.25		4.23
1908.												
1	4.19	3.65	3.80	5.10	6.05	5.80	5.52	3.92	3.88	3.20	3.40	3.75
2	4.16	3.65	3.90	5.10	6.25	5.80	5.78	3.88	3.78	3.12	3.52	3.75
3	4.11	3.64	3.85	5.10	6.40	5.80	6.09	3.85	3.82	3.10	3.60	3.65
4	4.10	3.64	3.84	5.15	6.30	5.75	5.98	3.80	3.85	3.15	3.58	3.60
5	4.08	3.64	3.82	5.10	6.25	5.80	5.65	3.75	3.85	3.15	3.48	3.50

[a] Water over gage January 19 to 23.

[b] No record February 21 to 27. The river began to freeze January 1, and the ice went out February 9. Maximum thickness, 2 feet.

Daily gage height, in feet, of Yakima River at Umtanum, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	4.08	3.62	3.80	5.00	6.22	5.85	5.45	3.80	5.85	3.15	3.40	3.50
7	4.06	3.65	3.70	4.90	6.45	6.25	5.36	3.85	3.78	3.15	3.38	3.50
8	4.05	3.65	3.68	4.85	6.70	6.52	5.30	3.88	3.62	3.14	3.32	3.50
9	4.04	3.62	3.70	4.95	6.70	6.98	5.25	3.88	3.42	3.12	3.32	3.49
10	4.04	3.60	3.74	5.10	6.40	7.38	5.28	3.70	3.40	3.18	3.29	3.45
11	4.02	3.60	3.82	5.20	6.18	7.50	5.30	3.75	3.40	3.34	3.30	3.42
12	3.99	3.58	4.15	5.55	6.00	7.45	5.30	3.75	3.40	3.30	3.30	3.42
13	3.98	3.56	4.55	5.72	5.85	7.18	5.30	3.70	3.40	3.35	3.35	3.52
14	3.95	3.56	5.95	5.90	5.80	6.95	5.41	3.72	3.45	3.48	3.35	3.55
15	3.90	3.56	6.30	5.85	6.00	6.85	5.44	3.70	3.58	3.46	3.35	3.55
16	3.88	3.56	7.40	5.80	6.25	6.78	5.58	3.62	3.62	3.42	3.35	3.59
17	3.88	3.76	6.85	5.85	6.32	6.45	5.72	3.60	3.70	3.40	3.35	3.54
18	3.87	3.70	6.40	6.20	6.30	6.15	5.48	3.58	3.60	3.38	3.35	3.50
19	3.83	3.70	6.20	6.85	6.38	5.90	5.25	3.60	3.60	3.38	3.55	3.50
20	3.82	3.68	6.10	7.30	6.42	5.72	5.08	3.65	3.52	3.30	3.66	3.55
21	3.79	3.63	5.95	7.50	6.40	5.50	4.90	3.68	3.50	3.30	3.75	3.55
22	3.78	3.60	5.60	7.25	6.35	5.32	4.79	3.70	3.42	3.30	4.10	3.55
23	3.76	3.60	5.60	6.70	6.30	5.20	4.65	3.70	3.40	3.25	4.22	3.54
24	3.75	3.62	6.00	6.50	6.30	5.20	4.62	3.68	3.35	3.20	4.30	3.50
25	3.75	3.66	6.25	6.30	6.42	5.25	4.60	3.65	3.30	3.19	4.25	3.55
26	3.75	3.74	6.15	6.28	6.50	5.45	4.52	3.65	3.30	3.18	4.08	3.55
27	3.74	3.78	5.80	6.18	6.45	5.70	4.42	3.65	3.29	3.18	3.90	3.68
28	3.70	3.78	5.65	6.10	6.32	5.62	4.28	3.65	3.26	3.18	3.88	3.70
29	3.70	3.79	5.45	5.78	6.18	5.47	4.18	3.82	3.25	3.15	3.85	3.85
30	3.70	.....	5.36	5.88	6.05	5.40	4.05	3.95	3.25	3.15	3.80	3.88
31	3.68	.....	5.30	.....	5.88	.....	4.00	3.90	.....	3.28	.....	3.80

Rating table for Yakima River at Umtanum, Wash., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	260	3.90	1,150	4.90	2,550	5.90	4,710
3.00	320	4.00	1,260	5.00	2,720	6.00	4,980
3.10	390	4.10	1,380	5.10	2,900	6.20	5,520
3.20	470	4.20	1,510	5.20	3,100	6.40	6,080
3.30	550	4.30	1,640	5.30	3,300	6.60	6,670
3.40	640	4.40	1,770	5.40	3,510	6.80	7,280
3.50	730	4.50	1,910	5.50	3,730	7.00	7,910
3.60	830	4.60	2,060	5.60	3,960	7.20	8,580
3.70	930	4.70	2,220	5.70	4,200	7.40	9,290
3.80	1,040	4.80	2,380	5.80	4,450	7.60	10,030

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 10 discharge measurements made during 1906, 1907, and 1908, and is well defined between gage heights 3.0 feet and 7.1 feet.

Monthly discharge of Yakima River at Umtanum, Wash., for 1906 to 1908.

[Drainage area, 1,540 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
August 25-31	369	290	326	0.212	0.06	4,530	A.
September	502	302	368	.239	.27	21,900	A.
October	6,080	470	1,370	.890	1.03	84,200	A.
November[a]	41,000	1,260	8,980	5.83	6.50	534,000	C.
December	4,660	1,690	2,570	1.67	1.92	158,000	A.

[a] Discharges for November 15 and 17 to 27 have been estimated, by the aid of a hydrograph, following the rate of rise and fall at the station at Union Gap and on Clealum River at Roslyn.

Monthly discharge of Yakima River at Umtanum, Wash., for 1906 to 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.[a]							
January	.....	.....	1,590	1.03	1.19	97,800	C.
February	5,470	.....	3,490	2.27	2.36	194,000	B.
March	4,200	1,900	2,740	1.78	2.05	168,000	A.
April	8,010	1,740	4,450	2.89	3.22	265,000	A.
May	.....	5,060	8,420	5.47	6.31	518,000	B.
June	.....	.....	3,520	2.29	2.56	209,000	B.
July	.....	.....	1,170	.760	.88	71,900	B.
August	770	398	577	.375	.43	35,500	A.
September	850	494	691	.449	.50	41,100	A.
October	676	478	554	.360	.42	34,100	A.
November	1,360	494	676	.439	.49	40,200	A.
December	1,900	1,130	1,480	.961	1.11	91,000	A.
The year	.....	.....	2,450	1.58	21.52	1,770,000	
1908.							
January	1,500	910	1,160	.753	.87	71,300	A.
February	1,030	790	880	.571	.62	50,600	A.
March	9,290	910	3,440	2.23	2.57	212,000	A.
April	9,660	2,460	4,740	3.08	3.44	282,000	A.
May	6,970	4,450	5,730	3.72	4.29	352,000	A.
June	9,660	3,100	5,400	3.51	3.92	321,000	A.
July	5,220	1,260	3,060	1.99	2.29	188,000	A.
August	1,200	810	979	.636	.73	60,200	A.
September	1,130	510	770	.500	.56	45,800	A.
October	712	390	510	.331	.38	31,400	A.
November	1,640	542	864	.561	.63	51,400	A.
December	1,130	658	813	.528	.61	50,000	A.
The year	9,660	390	2,360	1.53	20.91	1,720,000	

[a] Discharges for periods when there were ice conditions, or when gage was not read, have been estimated by multiplying the discharge at Clealum by the following coefficients: January 1 to February 9, 1.50; May 21 to 31, 1.25; June, 1.05; July, 1.00; August 1 to 9, 0.90; Comparisons of the discharge at the two stations for periods covered by the records indicate that these are the most probable ratios.

YAKIMA RIVER NEAR YAKIMA, WASH.

This station, which is located at Union Gap, a narrow gap in the lower Yakima-Moxee valleys, was established August 14, 1893, but discharge can be computed only from August 19, 1895, as the records are fragmentary prior to that date. The station is of great importance in determining the discharge, as it is unaffected by the diversions for the large irrigated areas above and below. It is just below the mouth of Atanum Creek and above the head gate of the New Reservation canal, the distance between these points being less than one-half mile. The discharge at this point is approximately equal to the sum of the discharge of Yakima River at Umtanum and Naches River at North Yakima, Atanum Creek, the return waters in the Selah and Moxee valleys and the waste from the North Yakima power canal. The records show also the amount of water available for the Sunnyside, the Old and the New Reservation canals, all of which have their intakes a short distance below.

The records were fairly reliable until the flood of November 15, 1906, which so deepened the channel at the measuring section that

the current is very sluggish at low water. The flood also deepened a small channel near the left bank, which previously did not carry water except at flood periods, but which now carries a considerable portion of the flow even at medium stages. On account of these changes it has been impossible since the above date to obtain reliable estimates of discharge. The record of gage heights is nearly complete for 1908, but no rating table can be applied to them, as no measurements were made during 1908. The discharge has been computed, however, by adding the flow of the three canals to the flow over the Sunnyside dam.

The datum of the gage has not been changed since the station was established, but a number of rating curves have been used on account of changing conditions.

The river frequently freezes during the winter months, and ice jams are common in the vicinity of the station. The discharge can seldom be corrected for these conditions and is therefore liable to some error.

Discharge measurements of Yakima River near Yakima, Wash., for 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 20	W. C. Muldrow	300	2,190	7.03	7,740
February 22	do	300	2,490	7.69	9,780
March 13	do	242	1,850	5.92	4,950
March 26	H. D. McGlashan	240	1,700	5.37	3,810
May 3	do	346	2,440	7.60	9,460
June 3	do	381	2,720	8.42	14,000
August 6	do	231	1,260	3.50	946
September 26	J. C. Stevens	226	1,270	3.50	883

Daily gage height, in feet, of Yakima River near Yakima, Wash., for 1907 and 1908.

[Hugh Kennedy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.5	4.9	7.0	5.3	7.5	8.9	5.8	3.7	3.5	3.5	3.55	4.75
2	5.5	4.9	6.9	5.4	7.5	8.6	5.7	3.7	3.55	3.5	3.55	4.8
3	5.4	4.8	6.9	5.4	7.6	8.4	5.6	3.65	3.9	3.45	3.55	4.7
4	5.4	4.7	6.9	5.5	7.9	8.3	5.5	3.6	3.9	3.45	3.55	4.65
5	5.4	4.6	6.4	5.55	8.1	8.3	5.4	3.6	3.8	3.45	3.55	4.6
6	5.2	5.0	6.3	5.6	8.7	8.0	5.4	3.6	3.8	3.5	3.55	4.5
7	5.0	5.3	6.3	5.7	9.0	7.9	5.5	3.55	3.8	3.5	3.55	4.5
8	4.9	6.3	6.25	5.75	9.1	7.6	5.2	3.6	3.8	3.45	3.55	4.4
9	4.8	6.9	6.2	5.8	9.3	7.3	5.0	3.65	3.8	3.45	3.55	4.35
10	4.9	7.3	6.1	5.9	9.1	7.1	4.9	3.6	3.7	3.45	3.55	4.35
11	4.9	7.7	6.15	6.1	9.0	7.0	4.9	3.6	3.7	3.4	3.55	4.35
12	5.0	7.3	6.1	6.1	8.3	6.9	4.8	3.6	3.75	3.4	3.55	4.3
13	4.9	7.0	6.0	6.15	7.9	6.9	4.7	3.6	3.75	3.5	3.55	4.3
14	4.7	6.8	5.9	7.8	8.1	6.65	4.7	3.6	3.7	3.5	3.55	4.4
15	4.5	6.6	6.1	8.0	8.5	6.5	4.65	3.5	3.75	3.45	3.5	4.5
16	4.4	6.5	6.2	8.2	9.15	6.3	4.6	3.4	3.7	3.5	3.5	4.4
17	4.4	6.3	6.3	8.2	9.1	6.0	4.55	3.4	3.7	3.5	3.5	4.2
18	4.5	6.0	6.0	8.15	9.6	5.9	4.5	3.4	3.75	3.5	3.55	4.1
19	4.5	6.1	5.9	7.9	9.4	6.0	4.4	3.35	3.8	3.5	3.5	4.1
20	4.5	7.0	5.8	7.6	9.0	6.0	4.4	3.35	3.75	3.5	3.55	4.1

NOTE.—From January 15 to February 17, 1907, the river was frozen about one-third the width to a thickness of about 7 inches.

Daily gage height, in feet, of Yakima River near Yakima, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	4.75	8.3	5.8	7.9	8.9	6.3	4.3	3.4	3.7	3.5	3.6	4.1
22	5.1	8.1	5.7	7.9	8.5	6.2	4.2	3.45	3.7	3.5	3.6	4.2
23	5.2	7.9	5.6	8.4	8.3	6.0	4.2	3.5	3.65	3.45	3.65	4.4
24	5.15	7.6	5.5	8.6	8.2	6.0	4.15	3.45	3.7	3.45	3.8	4.7
25	5.1	7.6	5.4	8.4	8.2	5.9	4.0	3.5	3.7	3.5	4.0	4.8
26	5.0	7.5	5.35	8.0	8.2	5.9	3.9	3.55	3.6	3.5	4.2	5.0
27	5.0	7.3	5.35	8.0	8.1	5.9	3.85	3.5	3.6	3.5	4.4	4.9
28	4.9	7.1	5.3	7.9	8.2	6.0	3.8	3.5	3.5	3.5	4.5	4.8
29	4.9	.....	5.2	7.7	8.5	6.1	3.8	3.5	3.5	3.5	4.6	4.8
30	4.8	.....	5.2	7.6	8.7	5.9	3.7	3.45	3.5	3.55	4.7	4.7
31	4.8	.....	5.25	.....	8.8	.....	3.7	3.45	.....	3.55	.....	4.7
1908.												
1	4.6	3.75	4.15	5.8	7.0	.....	6.9	4.3	3.7	3.65	3.9	3.9
2	4.5	3.8	4.1	5.8	7.3	.....	7.2	4.3	3.65	3.65	4.0	3.7
3	4.4	3.9	4.1	5.9	7.3	.....	7.5	4.2	3.6	3.65	4.0	3.6
4	4.4	3.9	4.0	5.95	7.3	.....	7.55	4.2	3.6	3.65	3.9	3.8
5	4.35	3.9	4.0	5.65	7.3	.....	7.0	4.1	3.6	3.6	3.9	3.9
6	4.35	3.8	4.0	5.4	7.4	.....	6.8	4.0	3.6	3.6	3.9	3.9
7	4.3	3.8	4.0	5.4	7.7	.....	6.6	4.0	3.6	3.6	3.9	3.9
8	4.3	3.8	4.0	5.3	8.0	.....	6.6	4.0	3.6	3.6	3.9	3.9
9	4.3	3.9	4.0	5.3	.....	.....	6.5	4.0	3.6	3.6	3.9	3.9
10	4.3	3.9	4.1	5.5	.....	.....	6.4	4.0	3.45	3.65	3.9	3.9
11	4.3	3.9	4.3	5.7	.....	.....	6.4	4.0	3.4	3.6	3.85	3.85
12	4.3	3.8	4.5	5.7	.....	.....	6.5	3.9	3.4	3.6	3.8	4.0
13	4.2	3.8	4.7	5.8	.....	.....	6.75	3.9	3.4	3.6	3.8	4.0
14	4.25	3.8	4.7	5.9	.....	8.8	6.9	3.9	3.5	3.7	3.8	4.0
15	4.25	3.8	8.6	6.0	.....	8.9	6.8	3.9	3.45	3.9	3.85	4.0
16	4.2	3.9	9.2	6.5	.....	8.9	6.9	3.9	3.55	3.9	3.8	4.0
17	4.2	4.0	8.9	6.5	.....	8.3	6.7	3.9	3.7	3.85	3.8	3.9
18	4.2	4.0	7.9	6.55	.....	7.9	6.4	3.9	3.7	3.9	4.3	3.9
19	4.2	4.0	7.2	8.0	.....	7.3	6.0	3.85	3.7	3.9	4.5	3.9
20	4.25	4.0	6.9	9.0	.....	7.3	5.9	3.8	3.7	3.9	4.8	3.9
21	4.15	3.9	6.9	8.9	.....	7.0	5.6	3.8	3.65	3.9	4.9	3.7
22	4.1	3.9	6.9	8.7	.....	6.9	5.4	3.8	3.55	3.7	4.9	3.6
23	4.1	3.9	6.9	8.3	.....	6.3	5.4	3.85	3.6	3.6	4.1	3.6
24	4.1	3.9	7.0	8.0	.....	6.2	5.3	3.9	3.6	3.55	4.1	3.6
25	4.0	4.0	7.0	7.9	.....	6.4	5.3	3.9	3.65	3.5	4.1	3.9
26	3.9	4.0	7.0	7.0	.....	6.6	5.3	3.8	3.6	3.5	4.6	4.0
27	3.9	4.1	6.9	6.9	.....	6.9	5.3	3.8	3.65	3.6	4.2	4.0
28	3.9	4.1	6.6	6.8	.....	6.8	5.0	3.8	3.65	3.7	4.1	4.1
29	3.85	4.1	6.1	6.7	.....	6.6	4.9	3.75	3.7	3.7	4.0	4.0
30	3.85	.....	6.0	6.6	.....	6.8	4.6	3.7	3.7	3.7	4.0	4.0
31	3.8	.....	5.9	.....	.....	.....	4.6	3.75	.....	3.6	.....	3.9

Rating tables for Yakima River near Yakima, Wash.

JUNE 5, 1905, TO FEBRUARY 9, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.40	1,640	5.00	2,500	5.60	3,600	6.40	5,600
4.50	1,760	5.10	2,670	5.70	3,810	6.60	6,220
4.60	1,890	5.20	2,840	5.80	4,030	6.80	6,890
4.70	2,030	5.30	3,020	5.90	4,260	7.00	7,590
4.80	2,180	5.40	3,210	6.00	4,500		
4.90	2,340	5.50	3,400	6.20	5,030		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1905–6, and is well defined between gage heights 3.5 feet and 7.7 feet.

Rating tables for Yakima River near Yakima, Wash.—Continued.

FEBRUARY 10, 1907, TO APRIL 30, 1908.[b]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
3.30	720	4.60	2,300	5.90	4,780	7.40	8,990
3.40	810	4.70	2,460	6.00	5,000	7.60	9,730
3.50	900	4.80	2,630	6.10	5,230	7.80	10,520
3.60	1,000	4.90	2,810	6.20	5,470	8.00	11,420
3.70	1,110	5.00	2,990	6.30	5,720	8.20	12,320
3.80	1,220	5.10	3,170	6.40	5,980	8.40	13,290
3.90	1,330	5.20	3,350	6.50	6,250	8.60	14,320
4.00	1,450	5.30	3,530	6.60	6,520	8.80	15,370
4.10	1,580	5.40	3,720	6.70	6,800	9.00	16,470
4.20	1,720	5.50	3,920	6.80	7,080	9.20	17,590
4.30	1,860	5.60	4,130	6.90	7,370	9.40	18,710
4.40	2,000	5.70	4,340	7.00	7,670	9.60	19,830
4.50	2,150	5.80	4,560	7.20	8,330		

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during 1907, and is fairly well defined between gage heights 3.5 feet and 8.5 feet.

Monthly discharge of Yakima River near Yakima, Wash., for 1907 and 1908.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	3,400	1,640	2,430	0.736	0.85	149,000	C.
February	12,800	1,890	6,740	2.04	2.12	374,000	C.
March	7,670	3,350	5,040	1.53	1.76	310,000	B.
April	14,300	3,530	8,430	2.55	2.84	502,000	B.
May	19,800	9,350	14,100	4.27	4.92	867,000	C.
June	15,900	4,780	7,640	2.32	2.59	455,000	B.
July	4,560	1,110	2,470	.748	.86	152,000	B.
August	1,110	765	930	.282	.33	57,200	B.
September	1,330	900	1,110	.336	.37	66,000	B.
October	950	810	884	.268	.31	54,400	B.
November	2,460	900	1,170	.355	.40	69,600	B.
December	2,990	1,580	2,160	.655	.76	133,000	B.
The year	19,800	765	4,430	1.34	18.11	3,190,000	
1908.							
January	2,300	1,220	1,710	.518	.60	105,000	C.
February	1,580	1,160	1,340	.406	.44	77,100	C.
March	17,600	1,450	5,570	1.69	1.95	342,000	C.
April	16,500	3,530	7,090	2.15	2.40	422,000	C.
May	12,000	7,570	9,750	2.95	3.40	600,000	A.
June	17,400	6,140	10,400	3.15	3.51	619,000	A.
July	10,300	2,320	6,490	1.97	2.27	399,000	A.
August	2,170	1,260	1,580	.479	.55	97,200	B.
September	1,480	1,030	1,190	.361	.40	70,800	B.
October	1,540	915	1,120	.339	.39	68,900	B.
November	3,200	1,140	2,100	.636	.71	125,000	A.
December	2,020	1,160	1,610	.488	.56	99,000	A.
The year	17,600	915	4,160	1.26	17.18	3,020,000	

NOTE.—Discharges for May to December, 1908, were obtained by adding the flow of the Sunnyside, Old and New Reservation canals to the flow over the Sunnyside dam.

YAKIMA RIVER NEAR WAPATO, WASH.

This station, which was established April 25, 1908, is located at the headgate of the Sunnyside canal, which is owned and operated by the United States Reclamation Service. The flow at this point is controlled by a concrete diversion dam 500 feet long, of ogee cross section 7 feet high. (See Pl. VI.) The gage readings show the head of water on the crest of this dam and are obtained by means of a hook gage. The discharge measurements are made from a cable which spans the river 500 feet below the dam. A sluiceway in the dam is closed by means of flashboards during the irrigating season. On this account two rating curves have been developed; one for the sluiceway open and the other for the sluiceway closed. There is also a fish ladder near the sluiceway through which a small quantity of water flows all the time.

The results obtained at this station, when added to the diversions measured in the Sunnyside canal, the Old and New Reservation canals are comparable with records formerly obtained at Union Gap. The Old Reservation canal diverts water from the right bank of Yakima River, one-half mile above this station; the New Reservation canal takes it from the same bank 2 miles above. The Union Gap canal (Lombard Horseley ditch) diverts water from the Moxee Valley, which is carried to Union Gap to irrigate lands to the east and south of this station. During the irrigating season the natural flow at this point is augmented by the release of stored waters in Lakes Keechelus, Kachess, and Clealum, where temporary dams have been constructed and operated by the Reclamation Service.

The records obtained here are as reliable as can be obtained by calibration of a permanent overflow dam by means of a current meter, and, although the river is subject to freezing during the winter months, the ice conditions do not interfere with records at this point.

Discharge measurements of Yakima River near Wapato, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	H. D. McGlashan	292	1,820	[a] 2.85	8,930
June 20	J. C. Stevens	290	1,770	[a] 2.51	7,420
July 24	Hoyt and Allen	271	1,340	[a] 1.52	3,440
July 30	Allen and Oakes	270	981	[a] .78	1,460
August 7	C. F. Gleason	272	808	[a] .47	910
August 15	do	265	610	[b] .29	460
August 23	do	266	604	[b] .26	415
September 8	L. R. Allen	264	598	[b] .29	370
September 16	C. F. Gleason	261	536	[b] .20	290
September 26	do	260	475	[b] .12	220
November 4	Allen and Gleason	273	1,050	[a] 1.01	1,770

[a] Sluiceway open. [b] Sluiceway closed.

Daily gage heights, in feet, of Yakima River near Wapato, Wash., for 1908.

[W. R. Newland, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					2.54	2.43	2.44	0.65	0.40	0.10	0.51	1.00
2					2.76	2.40	2.76	.62	.34	.09	.92	.97
3					2.90	2.36	2.91	.60	.34	.06	.96	.90
4					2.86	2.35	2.87	.56	.36	.05	1.01	.88
5					2.74	2.34	2.61	.48	.37	.03	.93	.82
6					2.77	2.46	2.31	.46	.36	.01	.86	.80
7					2.98	2.80	2.24	.48	.35	.14	.82	.80
8					3.20	3.08	2.26	.51	.30	.18	.80	.82
9					3.10	3.64	2.30	.54	.22	.17	.78	.82
10					2.92	4.05	2.28	.47	.02	.16	.76	.79
11					2.74	4.26	2.24	.39	.02	.18	.74	.74
12					2.54	4.26	2.20	.34	.02	.28	.72	.78
13					2.42	4.09	2.36	.33	.03	.30	.71	.80
14					2.30	3.87	2.46	.34	.02	.42	.70	.84
15					2.36	3.84	2.58	.34	.13	.52	.69	.83
16					2.68	3.80	2.43	.28	.21	.52	.68	.80
17					2.76	3.58	2.53	.23	.26	.50	.70	.78
18					2.70	3.12	2.28	.20	.29	.49	1.01	.75
19					2.78	2.82	2.10	.18	.28	.42	1.28	(a)
20					2.83	2.60	1.94	.26	.26	.30	1.28	(a)
21					2.77	2.45	1.82	.30	.21	.26	1.30	(a)
22					2.74	2.18	1.71	.26	.14	.23	1.32	(a)
23					2.72	2.04	1.65	.28	.10	.20	1.40	(a)
24					2.78	1.99	1.53	.28	.05	.19	1.39	(a)
25				2.94	2.98	2.07	1.40	.24	.13	.16	1.35	(a)
26				2.71	3.09	2.44	1.28	.22	.14	.15	1.24	.89
27				2.55	2.96	2.56	1.18	.22	.14	.12	1.14	.92
28				2.45	2.84	2.40	1.04	.22	.12	.09	1.10	.96
29				2.31	2.78	2.30	.90	.34	.14	.13	1.05	.98
30				2.30	2.67	2.23	.82	.48	.11	.22	1.04	.97
31					2.58		.74	.46		.46		.94

[a] Gage frozen in from December 19 to 25.

NOTE.—The sluiceway was closed August 9 to October 18, inclusive, and open at other times.

Rating tables for Yakima River near Wapato, Wash., for 1908.

SLUICEWAY OPEN.[a]

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	360	1.90	4,820
.10	440	2.00	5,200
.20	540	2.10	5,600
.30	660	2.20	6,000
.40	800	2.30	6,420
.50	960	2.40	6,860
.60	1,130	2.50	7,320
.70	1,310	2.60	7,800
.80	1,510	2.70	8,280
.90	1,730	2.80	8,760
1.00	1,970	2.90	9,260
1.10	2,220	3.00	9,760
1.20	2,480	3.20	10,760
1.30	2,760	3.40	11,780
1.40	3,060	3.60	12,820
1.50	3,380	3.80	13,880
1.60	3,720	4.00	14,980
1.70	4,080	4.20	16,100
1.80	4,440	4.40	17,220

SLUICEWAY CLOSED.[b]

0.00	130	.40	550
.10	210	.50	700
.20	310	.60	860
.30	420	.70	1,020

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1908, and is well defined between gage heights 0.4 foot and 3.0 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908, and is fairly well defined.

Monthly discharge of Yakima River near Wapato, Wash., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
April 25–30	9,460	6,420	7,550	89,900	A.
May	10,800	6,420	8,620	530,000	A.
June	16,400	5,160	9,390	559,000	A.
July	9,310	1,390	5,470	336,000	A.
August	1,220	290	599	36,800	B.
September	550	146	316	18,800	B.
October	896	138	459	28,200	B.
November	3,060	977	1,950	116,000	A.
December	1,970	1,110	1,560	95,900	A.
The period				1,810,000	

YAKIMA RIVER AT KIONA, WASH.

This station, which was established August 20, 1895, is located in the town of Kiona, 23 miles above the mouth of the river. No tributaries enter in the vicinity of this station.

The chief value of the data lies in the fact that they cover a long period and are accurate. Much water is diverted from the river, both above and below the station. At the medium and high stages the total amount of diverted water is but a small per cent of the flow of the river, but at low stages this condition is reversed, and the water passing Kiona consists in large part of return water from irrigation. The data obtained here are, however, of value as indicating the flow at Prosser, which, on account of certain water rights, becomes of considerable importance. Between Prosser and Kiona, a distance of 14 miles, there is only one diversion of consequence, the Kiona canal. There is also a wasteway from the extremity of the Sunnyside canal where the amount wasted is measured, but as it flows in a natural channel to the river from the point of measurement a part of the water is again diverted in small ditches for irrigation. During the irrigating season little or no surface water reaches the river from this wasteway, although a large part of it, doubtless, finds its way through the gravel bed of the arroyo.

The flow at the gaging station is controlled by a riffle about 1,000 feet below the bridge, and this has made the development of a permanent rating curve possible. The gages have been altered during the life of the station, but all gage heights have been corrected to a uniform datum. During the winter months a small amount of ice is apt to form in the vicinity of the station, but only in exceptional seasons does this ice interfere with the determination of flow. The data of 1907–8 are not greatly complicated by ice conditions.

Discharge measurements of Yakima River at Kiona, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 2	W. C. Muldrow	303	2,090	8.94	9,010
April 10	H. D. McGlashan	289	1,760	7.75	6,580
August 14[a]	do	160	225	3.30	392
1908.					
May 7	H. D. McGlashan	304	2,120	9.00	9,710
September 9	L. R. Allen	212	664	3.58	583
November 9	do	213	915	4.70	1,550

[a] Measured by wading.

Daily gage height, in feet, of Yakima River at Kiona, Wash., for 1907 and 1908.

[J. H. Kennedy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	6.9	6.8	9.2	6.7	9.1	10.6	7.0	3.5	2.9	3.4	3.1	5.5
2	6.7	7.0	8.95	6.8	9.0	11.0	6.7	3.4	2.9	3.55	3.2	5.9
3	6.6	6.7	8.6	6.8	9.1	10.9	6.6	3.4	2.9	2.8	3.5	5.7
4	6.9	6.2	8.4	6.7	9.6	9.8	6.4	3.3	3.1	2.9	4.2	5.5
5	6.8	6.4	8.3	6.9	9.4	9.5	6.3	3.3	3.3	3.0	4.0	5.5
6	6.8	7.1	8.25	7.2	9.8	9.3	6.2	3.3	3.5	3.25	4.0	5.5
7	7.0	8.2	8.0	7.2	10.4	9.2	5.9	3.3	3.5	3.25	4.1	5.5
8	6.9	8.4	7.9	7.3	10.8	8.7	5.9	3.3	3.6	3.4	4.2	5.4
9	6.7	9.6	7.9	7.45	11.0	8.3	5.7	3.3	3.65	3.4	4.2	5.4
10	6.6	10.1	7.8	7.7	11.2	8.0	5.65	3.25	3.7	3.3	4.1	5.3
11	6.4	10.5	7.8	8.0	11.3	7.8	5.6	3.2	3.65	3.3	4.1	5.3
12	6.2	10.2	7.8	8.7	11.1	7.6	5.45	3.2	3.5	3.2	4.1	5.3
13	5.9	9.7	7.6	8.8	10.9	7.4	5.3	3.1	3.45	3.25	4.1	5.3
14	4.7	9.5	7.4	9.0	10.3	7.5	5.1	3.0	3.45	3.3	4.1	5.4
15	4.7	9.7	7.3	9.6	10.35	7.6	5.05	3.0	3.45	3.25	4.1	5.4
16	4.8	9.1	7.3	9.9	10.3	7.5	5.0	3.0	3.5	3.3	4.15	5.3
17	4.9	9.1	7.2	10.0	11.1	7.55	4.9	2.95	3.7	3.3	4.2	5.2
18	5.1	8.6	7.1	10.0	11.75	7.6	4.8	2.95	3.85	3.4	4.2	5.1
19	5.2	7.9	7.1	9.7	12.0	7.8	4.7	2.9	3.95	3.3	4.1	5.0
20	5.35	7.8	7.0	9.5	12.0	8.0	4.6	2.9	3.8	3.4	4.0	5.0
21	5.8	9.2	7.0	9.3	11.9	7.9	4.6	2.8	3.7	3.4	4.1	4.9
22	6.0	9.9	7.0	9.4	11.4	7.8	4.5	2.8	3.7	3.45	4.2	4.8
23	6.0	9.8	6.9	9.6	10.8	7.6	4.3	2.9	3.7	3.4	4.2	5.1
24	6.6	9.5	6.85	10.2	10.45	7.6	4.2	2.95	3.75	3.3	4.2	5.5
25	6.7	9.3	6.85	10.3	10.3	7.8	4.1	2.9	3.7	3.2	4.3	6.0
26	6.5	9.7	6.9	10.0	10.2	7.7	4.0	2.85	3.6	3.2	4.6	6.2
27	6.4	9.5	6.8	9.9	10.0	7.6	3.9	2.8	3.6	3.3	4.9	6.4
28	6.3	9.4	6.85	9.4	10.1	7.5	3.8	2.8	3.6	3.3	5.1	6.2
29	6.2	.....	6.8	9.4	10.2	7.3	3.8	2.85	3.5	3.2	5.1	6.1
30	6.2	.....	6.8	9.2	10.4	7.2	3.6	2.85	3.7	3.15	5.2	5.9
31	6.0	.....	6.7	.....	10.45	.....	3.65	2.9	.....	3.15	.....	5.9
1908.[b]												
1	5.80	4.50	5.00	7.40	8.10	8.45	7.72	4.80	3.18	3.30	3.86	4.60
2	5.60	4.20	5.10	7.10	8.60	8.30	8.20	4.55	3.22	3.68	4.10	5.02
3	5.60	4.50	5.10	7.00	9.00	8.25	8.65	4.45	3.45	3.30	4.70	5.03
4	5.50	4.40	5.10	7.00	9.20	8.10	9.25	4.40	3.45	3.33	4.92	4.96
5	5.40	4.70	5.05	7.00	9.10	8.10	8.90	4.25	3.45	3.30	5.32	4.83
6	5.40	4.70	5.15	6.90	8.95	8.05	8.30	4.15	3.40	3.00	5.45	4.82
7	5.40	5.20	5.00	6.80	9.00	8.35	7.85	3.95	3.45	3.20	5.72	4.73
8	5.40	5.05	5.00	6.60	9.35	8.90	7.68	3.84	3.52	3.55	4.71	4.77
9	5.40	4.90	4.90	6.40	9.58	9.60	7.80	3.78	3.60	3.15	4.70	4.76
10	5.50	4.80	4.90	6.50	9.47	10.40	7.80	3.80	3.63	3.00	4.62	4.74
11	5.50	4.70	5.00	6.70	9.18	11.00	7.80	3.80	3.55	3.95	4.60	4.72
12	5.30	4.70	5.00	7.05	8.80	11.35	7.60	3.75	3.48	3.21	4.55	4.75
13	5.30	4.70	5.20	7.55	8.48	11.50	7.60	3.65	3.44	3.00	4.54	4.52
14	5.30	4.70	5.80	8.00	8.22	11.25	8.20	3.60	3.65	2.95	4.50	4.68
15	5.20	4.70	8.45	8.20	8.00	10.88	8.30	3.50	3.35	3.12	4.50	4.78

[a] On January 1 the river froze about one-fourth way across from each bank, the ice varying from 2 to 8 inches in thickness. This ice went out February 5, forming an ice gorge and causing a sudden rise in gage height. There was probably ice obstruction during the latter part of February. There was a heavy flow of slush ice from January 1 to February 5, but the main channel was open at all times.

[b] There was slush ice January 31 and February 1; shore ice, February 2 and 3, 10 feet from either bank—2 inches thick. The main channel was clear throughout the year.

Daily gage height, in feet, of Yakima River at Kiona, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	5.20	4.70	9.20	8.00	8.40	10.82	8.40	3.45	3.22	3.42	4.49	4.73
17	5.10	4.80	10.80	8.00	8.78	10.70	8.20	3.40	3.38	3.80	4.50	4.66
18	5.10	5.00	10.90	8.00	8.80	10.22	8.15	3.32	3.40	3.95	4.49	4.92
19	5.10	5.00	9.80	9.00	8.85	9.45	7.80	3.20	3.45	3.88	4.84	4.65
20	5.10	5.00	9.10	10.30	9.00	8.90	7.50	3.15	3.54	3.86	4.86	4.59
21	5.30	4.90	9.00	11.00	9.10	8.50	7.18	3.12	3.58	3.89	5.62	4.70
22	5.10	4.90	8.60	11.20	9.00	8.10	7.00	3.05	3.56	3.87	5.65	4.75
23	5.00	4.90	8.20	10.75	8.90	7.70	6.72	3.00	3.55	3.86	5.73	4.82
24	5.00	4.80	8.10	10.10	8.90	7.45	6.52	3.05	3.40	3.88	5.80	4.90
25	5.00	4.90	9.00	9.70	9.00	7.30	6.40	3.12	3.37	3.77	5.31	4.80
26	4.90	4.90	9.00	9.50	9.40	7.68	6.18	3.25	3.38	3.79	.....	4.60
27	4.80	4.90	8.60	9.00	9.65	8.20	5.82	3.25	3.42	3.78	4.60	4.80
28	4.80	5.10	8.30	8.90	9.22	8.20	5.65	3.22	3.45	3.80	4.20	5.00
29	4.70	5.20	7.90	8.50	9.00	7.95	5.15	3.15	3.46	3.75	4.00	5.05
30	4.80	.....	7.70	8.15	8.88	7.75	5.00	3.20	3.50	3.78	4.42	5.10
31	4.90	.....	7.50	.....	8.73	.....	4.95	3.05	.....	3.78	.....	5.08

Rating table for Yakima River at Kiona, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	245	4.10	990	5.40	2,420	7.40	5,970
2.90	280	4.20	1,070	5.50	2,560	7.60	6,390
3.00	315	4.30	1,160	5.60	2,700	7.80	6,830
3.10	355	4.40	1,250	5.70	2,850	8.00	7,270
3.20	400	4.50	1,350	5.80	3,000	8.20	7,710
3.30	450	4.60	1,450	5.90	3,160	8.40	8,170
3.40	500	4.70	1,560	6.00	3,320	8.60	8,630
3.50	555	4.80	1,670	6.20	3,650	8.80	9,110
3.60	620	4.90	1,780	6.40	3,990	9.00	9,590
3.70	690	5.00	1,900	6.60	4,350	10.00	12,100
3.80	760	5.10	2,020	6.80	4,740	11.00	14,950
3.90	835	5.20	2,150	7.00	5,140	12.00	18,150
4.00	910	5.30	2,280	7.20	5,550		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on about 60 discharge measurements made during 1897-1908 and is well defined above gage height 2.5 feet.

Monthly discharge of Yakima River at Kiona, Wash., for 1907 and 1908.

[Drainage area, 5,230 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet	
1907.							
January [a]	.....	.....	3,080	0.589	0.68	189,000	C.
February [a]	.....	.....	7,770	1.49	1.55	432,000	C.
March	10,100	4,540	6,220	1.19	1.37	382,000	A.
April	13,000	4,540	9,000	1.72	1.92	536,000	A.
May	18,200	9,590	13,700	2.62	3.02	842,000	A.
June	15,000	5,550	7,970	1.52	1.70	474,000	A.
July	5,140	620	2,190	.419	.48	135,000	A.
August	555	245	350	.067	.08	21,500	B.
September	872	280	593	.113	.13	35,300	B.
October	588	245	437	.084	.10	26,900	B.
November	2,150	355	1,100	.210	.23	65,500	A.
December	3,990	1,670	2,590	.495	.57	159,000	B.
The year	18,200	245	4,580	.876	11.83	3,300,000	

[a] Open-channel discharges have been reduced 15 per cent to allow for ice conditions.

Monthly discharge of Yakima River at Kiona, Wash., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	3,000	1,560	2,180	0.417	0.48	134,000	B.
February	2,150	1,070	1,690	.323	.35	97,200	B.
March	14,700	1,780	6,010	1.15	1.33	370,000	B.
April	15,600	3,990	7,950	1.52	1.70	473,000	B.
May	11,200	7,270	9,420	1.80	2.08	579,000	A.
June	16,600	5,760	9,920	1.90	2.12	590,000	A.
July	10,200	1,840	6,070	1.16	1.34	373,000	A.
August	1,670	315	665	.127	.15	40,900	A.
September	655	391	530	.101	.11	31,500	A.
October	872	298	613	.117	.13	37,700	A.
November	3,000	805	1,740	.333	.37	104,000	A.
December	2,020	1,370	1,680	.321	.37	103,000	A.
The year	16,600	298	4,040	.772	10.53	2,930,000	

YAKIMA RIVER NEAR RICHLAND, WASH.

This station was established July 28, 1906, and has been maintained during irrigating seasons only.

The data are of particular value in showing the amount of water that is contributed by the Yakima to Columbia River during the irrigating season, after the irrigation requirements have been satisfied. It is located below all important diversions. In 1907 it was located at Richland Ferry, 8 miles above Kennewick, 2½ miles above the mouth of the river. As conditions were poor it was necessary to use temporary gages which were washed out at the first rise in the fall, and the station was discontinued as soon as the river rose to a height where measurements could not be made by wading. During 1908 it was located at the bridge 3 miles below its former position, but an insufficient number of measurements were made to form the basis of an estimate of flow. The gage heights, however, will be applicable to a rating curve developed later, as the channel conditions are stable.

The following measurement was made August 13, 1907, 1,000 feet above the bridge:

Width, 140 feet; area, 142 square feet; gage height, 2.50 feet; discharge, 199 second-feet.

Daily gage height, in feet, of Yakima River near Richland, Wash., for 1907 and 1908.

[Ralph Bremmer, observer.]

Day.	1907.					1908.				
	Aug.	Sept.	Oct.	Nov.	Dec.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.40	2.88	3.40	4.60	.....	2.52	2.68	3.00	4.15
2	.....	2.28	2.92	3.20	.....	.....	2.61	2.62	3.20	4.20
3	.....	2.35	2.89	3.60	.....	.....	2.70	2.70	3.70	4.05
4	.....	2.50	2.86	3.40	.....	.....	2.70	2.70	3.90	4.20
5	.....	2.68	2.82	3.40	.....	.....	2.70	2.70	4.10	4.05

Daily gage height, in feet, of Yakima River near Richland, Wash., for 1907 and 1908—Con.

Day.	1907.					1908.				
	Aug.	Sept.	Oct.	Nov.	Dec.	Aug.	Sept.	Oct.	Nov.	Dec.
6	.....	2.75	2.81	3.60	.....	.....	2.70	2.60	4.00	4.00
7	.....	2.83	2.62	3.40	.....	.....	2.68	2.55	4.00	3.90
8	.....	2.90	2.89	3.40	.....	.....	2.71	2.80	3.90	3.80
9	.....	2.90	2.90	3.40	.....	.....	2.81	2.80	3.60	3.80
10	.....	2.95	2.89	3.50	.....	.....	2.92	2.65	3.60	3.90
11	.....	2.95	2.85	3.40	.....	.....	3.00	2.40	3.60	3.90
12	.....	2.83	2.78	3.40	.....	.....	2.78	3.00	3.60	4.00
13	.....	2.80	2.75	3.40	.....	.....	2.78	2.55	3.60	4.00
14	.....	2.80	2.70	3.40	.....	.....	2.68	2.70	3.70	3.90
15	.....	2.80	2.85	3.40	.....	.....	2.65	2.50	3.70	3.90
16	.....	2.80	2.85	3.40	.....	.....	2.60	2.70	3.70	3.95
17	.....	2.85	2.85	3.40	.....	.....	2.50	3.00	3.70	3.95
18	.....	2.90	2.90	3.40	.....	.....	2.60	3.30	3.70	3.90
19	.....	2.92	3.00	3.45	.....	.....	2.65	3.30	3.70	3.75
20	.....	3.38	2.95	3.40	.....	.....	2.78	3.20	4.45	3.75
21	.....	3.12	3.00	3.40	.....	.....	2.80	3.20	4.50	3.75
22	.....	3.60	3.00	3.40	.....	.....	2.80	3.30	4.50	3.70
23	2.35	3.50	2.88	3.40	.....	.....	2.78	3.20	4.50	3.65
24	2.22	2.98	3.00	3.40	.....	.....	2.75	3.30	4.50	3.60
25	2.35	2.98	2.88	3.55	.....	.....	2.70	3.10	4.60	3.60
26	2.25	2.88	2.90	3.55	.....	.....	2.70	3.10	4.50	3.80
27	2.18	2.88	2.98	4.20	.....	.....	2.65	3.10	4.50	3.80
28	2.21	2.88	2.90	4.50	.....	2.52	2.70	3.10	4.30	3.95
29	2.33	2.88	2.95	4.50	.....	2.55	3.00	3.10	4.20	3.90
30	2.32	2.85	2.95	4.50	.....	2.50	2.90	3.25	4.20	4.00
31	2.33	.....	2.95	.....	.....	2.53	.....	3.10	.....	4.10

KACHESS LAKE NEAR EASTON, WASH.

Kachess Lake is divided into two parts, known as Kachess and Little Kachess, which are connected by a short channel called The Narrows. The elevation of the water surface is 2,230 feet above sea level, and the superficial area at the medium stage is 3,600 acres. A gage was established in Lake Kachess September 20, 1905. It is located about 300 feet above the dam at the outlet. The gage datum in this lake is at an elevation of 2,227.02 feet above sea level and has not been changed since the gage was installed.

Daily gage height, in feet, of Kachess Lake near Easton, Wash., for 1907 and 1908.

[H. A. Shandy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.85	1.60	2.20	1.30	2.70	4.45	5.85	5.50	3.88	1.85	0.33	1.50
2	1.80	1.65	2.25	1.30	2.75	4.40	5.85	5.50	3.84	1.78	.33	1.55
3	1.90	1.70	2.20	1.25	2.80	4.30	5.85	5.55	3.75	1.65	.34	1.40
4	2.05	1.75	2.10	1.25	2.90	4.20	5.80	5.60	3.65	1.55	.34	1.50
5	2.05	1.75	2.05	1.30	2.95	4.10	5.80	5.50	3.58	1.48	.35	1.50
6	2.00	1.85	2.00	1.35	3.10	4.00	5.75	5.50	3.50	1.35	.36	1.50
7	1.90	1.90	1.95	1.45	3.20	3.90	5.75	5.50	3.44	1.25	.40	1.45
8	1.80	2.10	1.90	1.40	3.60	3.70	5.70	5.50	3.35	1.20	.35	1.40
9	1.75	2.20	1.85	1.45	3.80	3.65	5.60	5.55	3.23	1.10	.30	1.35
10	1.70	2.55	1.85	1.55	3.85	3.50	5.60	5.55	3.15	1.02	.30	1.35
11	1.70	2.60	1.80	1.70	3.95	3.55	5.60	5.50	3.09	.95	.30	1.40
12	1.65	2.65	1.80	1.75	3.90	3.75	5.60	5.50	3.05	.89	.30	1.40
13	1.60	2.60	1.80	1.80	3.85	3.85	5.55	5.50	2.93	.80	.25	1.45
14	1.60	2.60	1.80	1.80	3.85	3.90	5.50	5.50	2.87	.78	.28	1.50
15	1.55	2.55	1.80	2.00	3.90	4.00	5.50	5.50	2.82	.70	.27	1.45

Daily gage height, in feet, of Kachess Lake near Easton, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	1.50	2.50	1.85	2.10	4.20	4.25	5.50	5.45	2.80	0.68	0.30	1.35
17	1.50	2.45	1.75	2.20	4.40	4.40	5.50	5.40	2.72	.64	.29	1.30
18	1.50	2.30	1.65	2.25	4.50	4.60	5.50	5.35	2.68	.60	.27	1.25
19	1.55	2.30	1.60	2.30	4.60	4.90	5.50	5.22	2.56	.55	.30	1.25
20	1.50	2.20	1.55	2.30	4.65	5.05	5.50	5.02	2.53	.52	.40	1.25
21	1.55	2.20	1.50	2.30	4.55	5.20	5.50	4.93	2.45	.50	.45	1.30
22	1.55	2.20	1.50	2.35	4.50	5.30	5.50	4.84	2.40	.45	.50	1.30
23	1.50	2.20	1.45	2.45	4.40	5.45	5.50	4.75	2.34	.42	.55	1.35
24	1.50	2.25	1.40	2.60	4.30	5.60	5.50	4.63	2.28	.40	.80	1.40
25	1.50	2.25	1.40	2.65	4.25	5.60	5.50	4.52	2.20	.38	.95	1.50
26	1.50	2.20	1.35	2.70	4.25	5.75	5.50	4.44	2.15	.34	1.10	1.70
27	1.45	2.20	1.30	2.75	4.30	5.80	5.50	4.35	2.08	.32	1.00	1.70
28	1.45	2.15	1.30	2.70	4.30	5.90	5.50	4.25	2.00	.30	1.10	1.80
29	1.40	.....	1.30	2.70	4.35	5.90	5.50	4.13	1.96	.30	1.20	1.85
30	1.40	.....	1.30	2.70	4.45	5.90	5.50	4.05	1.92	.31	1.30	1.80
31	1.55	.....	1.30	.....	4.50	.....	5.50	3.99	.....	.32	.....	1.80
1908.												
1	1.75	0.65	0.60	2.35	3.00	5.15	5.35	5.15	2.98	0.80	0.70	1.20
2	1.70	.65	.60	2.25	3.10	5.10	5.40	5.05	2.97	.78	.80	1.15
3	1.70	.70	.65	2.10	3.20	5.10	5.40	4.96	2.97	.70	.80	1.10
4	1.65	.75	.60	2.05	3.20	5.05	5.35	4.86	2.96	.65	.85	1.05
5	1.55	.75	.60	2.00	3.20	5.00	5.40	4.80	2.96	.61	.90	1.00
6	1.55	.60	.55	2.00	3.20	5.00	5.35	4.70	2.95	.58	.95	1.00
7	1.50	.65	.55	2.05	3.40	5.10	5.40	4.65	2.94	.58	.92	.95
8	1.40	.70	.55	1.95	3.60	5.20	5.40	4.55	2.92	.55	.95	.90
9	1.30	.75	.50	1.90	3.70	5.40	5.43	4.48	2.86	.49	.97	.87
10	1.25	.75	.55	1.85	3.75	5.50	5.45	4.38	2.77	.44	.99	.87
11	1.25	.70	.60	1.80	3.75	5.60	5.45	4.35	2.68	.44	1.00	.86
12	1.20	.75	.60	1.85	3.75	5.55	5.43	4.25	2.60	.42	.99	.90
13	1.20	.70	.80	1.90	3.75	5.45	5.43	4.15	2.52	.40	.98	.90
14	1.15	.70	1.40	1.95	3.75	5.30	5.43	4.05	2.37	.48	.98	.92
15	1.10	.75	1.80	1.95	3.75	5.20	5.40	4.00	2.10	.50	1.00	.90
16	1.05	.70	2.65	2.00	3.80	5.00	5.55	3.98	1.95	.50	1.00	.89
17	1.10	.70	3.10	2.10	3.85	4.90	5.40	3.90	1.80	.50	1.08	.89
18	1.05	.60	3.15	2.40	3.90	4.90	5.38	3.81	1.70	.47	1.25	.86
19	1.10	.60	3.10	2.70	3.95	4.90	5.30	3.70	1.58	.48	1.50	.84
20	1.15	.60	3.00	3.00	4.15	4.85	5.30	3.60	1.46	.52	1.50	.81
21	1.10	.65	2.90	3.20	4.30	4.90	5.25	3.55	1.34	.50	1.60	.79
22	1.05	.65	2.80	3.30	4.45	4.90	5.20	3.42	1.22	.50	1.60	.78
23	1.00	.70	2.85	3.40	4.65	4.90	5.38	3.40	1.08	.50	1.60	.76
24	.95	.60	2.80	3.35	4.85	4.95	5.32	3.30	1.02	.49	1.58	.76
25	.85	.50	2.80	3.35	5.00	5.15	5.35	3.20	.98	.48	1.50	.80
26	.80	.55	2.75	3.25	5.05	5.25	5.35	3.10	.86	.48	1.40	.90
27	.80	.60	2.75	3.20	5.00	5.35	5.30	3.05	.82	.48	1.40	1.00
28	.75	.60	2.60	3.15	5.00	5.35	5.25	3.02	.80	.49	1.35	1.10
29	.75	.60	2.50	3.05	5.10	5.30	5.25	3.01	.78	.48	1.30	1.05
30	.70	.....	2.45	3.00	5.15	5.30	5.20	2.99	.78	.49	1.27	1.05
31	.70	.....	2.40	.....	5.20	.....	5.17	2.99	.....	.60	.....	1.00

Table showing volume of storage on Kachess Lake near Easton, Wash., for 1905–1908.

Gage height.	Storage.	Gage height.	Storage.	Gage height.	Storage.
Feet.	*Acre-feet.*	*Feet.*	*Acre-feet.*	*Feet.*	*Acre-feet.*
0.00	00	5.00	17,890	10.00	36,630
1.00	3,510	6.00	21,570	11.00	40,480
2.00	7,050	7.00	25,280	12.00	44,370
3.00	10,630	8.00	29,030		
4.00	14,240	9.00	32,810		

NOTE.—This table has been used to determine the amount of water stored in, or drawn from, the lake, and in connection with the records on Kachess River, to compute the inflow into the lake.

KACHESS RIVER NEAR EASTON, WASH.

This station, which was established October 14, 1903, is located one-half mile below the outlet of Lake Kachess and 2 miles northwest of Easton. The river receives no important tributaries.

This station is of great value, as the records determine the amount of water available for storage in Lake Kachess, which forms one of the principal reservoirs under consideration by the United States Reclamation Service, and will probably be the first one constructed on the headwaters of Yakima River.

The channel is open throughout the entire year at this point. The current is swift and ice does not form. The channel conditions at the station are not favorable for a high degree of accuracy. The bed is composed of gravel and cobblestones and at low stages it is difficult to measure depths accurately. The datum of the gage, which is 2,178.41 feet above sea level, has not been altered since it was established, and except for slight modifications at the low stages a single discharge curve has been used.

The flow is under artificial control, the lake being used for storage by the Cascade Canal Company prior to its acquisition by the United States Reclamation Service.

Discharge measurements of Kachess River near Easton, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
April 1	H. D. McGlashan	69	98	3.72	159
May 28	do	77	272	6.00	1,010
June 11	Stevens and McGlashan	74	165	4.64	447
August 7	H. D. McGlashan	58	56	3.13	43
1908.					
July 17	L. R. Allen	73	163	4.72	482
August 19	C. F. Gleason	70	101	3.87	225
September 19	L. R. Allen	68	108	3.97	230
November 17	do	56	56	3.21	51

Daily gage height, in feet, of Kachess River near Easton, Wash., for 1907 and 1908.

[H. A. Shandy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.00	3.85	4.20	3.70	4.7	6.05	4.20	3.00	3.78	3.68	3.20	4.15
2	4.00	3.85	4.25	3.70	4.75	6.10	4.20	3.00	3.77	3.96	3.20	3.95
3	4.05	3.90	4.15	3.70	4.8	6.00	4.10	3.00	3.77	3.95	3.19	3.90
4	4.00	3.90	4.15	3.70	4.9	5.90	4.10	3.10	3.76	3.94	3.19	3.85
5	4.00	3.95	4.05	3.70	5.0	5.80	4.10	3.10	3.76	3.93	3.18	3.90
6	4.00	3.95	4.05	3.70	5.1	5.75	4.10	3.00	3.75	3.90	3.20	3.90
7	4.00	3.95	4.05	3.80	5.25	5.60	4.00	3.00	3.75	3.85	3.30	3.85
8	3.95	4.05	4.05	3.80	5.45	5.50	4.00	3.00	3.75	3.80	3.25	3.80
9	3.90	4.15	4.05	3.80	5.65	5.40	4.00	3.00	3.74	3.75	3.30	3.75
10	3.90	4.45	4.05	3.90	5.65	5.35	3.95	3.00	3.74	3.70	3.31	3.75
11	3.85	4.60	4.05	4.00	5.75	4.20	3.95	3.00	3.74	3.64	3.31	3.80
12	3.85	4.60	4.05	4.00	5.65	3.90	3.95	3.00	3.73	3.61	3.31	3.80
13	3.85	4.55	4.05	4.00	5.55	3.80	3.90	3.00	3.73	3.58	3.25	3.85
14	3.80	4.50	4.05	4.10	5.55	3.60	3.90	3.20	3.73	3.50	3.28	3.90
15	3.80	4.50	4.05	4.15	5.70	3.15	3.90	3.30	3.72	3.42	3.27	3.95

Daily gage height, in feet, of Kachess River near Easton, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.80	4.45	4.10	4.30	5.80	3.10	3.60	3.30	3.71	3.34	3.30	3.90
17	3.75	4.40	4.05	4.40	5.95	3.10	3.50	3.35	3.71	3.28	3.29	3.85
18	3.75	4.30	3.95	4.45	5.95	3.10	3.50	4.12	3.71	3.20	3.27	3.80
19	3.75	4.30	3.90	4.45	6.00	3.10	3.00	4.09	3.71	3.12	3.30	3.80
20	3.75	4.25	3.90	4.45	6.10	3.20	3.00	4.05	3.70	3.12	3.40	3.80
21	3.80	4.25	3.90	4.45	6.20	3.20	3.00	4.03	3.70	3.11	3.45	3.85
22	3.80	4.25	3.85	4.50	6.10	3.30	3.00	3.99	3.70	3.11	3.50	3.90
23	3.80	4.25	3.80	4.60	6.00	3.30	3.00	3.96	3.70	3.11	3.55	3.90
24	3.80	4.25	3.80	4.65	6.00	3.50	3.00	3.92	3.70	3.11	3.85	3.90
25	3.80	4.25	3.80	4.70	5.90	3.80	3.00	3.90	3.69	3.10	3.95	4.00
26	3.80	4.20	3.75	4.70	5.90	3.90	3.00	3.87	3.69	3.10	4.05	4.20
27	3.80	4.20	3.75	4.75	5.95	3.90	3.00	3.85	3.69	3.10	3.90	4.20
28	3.75	4.20	3.70	4.7	6.00	4.20	3.00	3.83	3.69	3.10	4.00	4.25
29	3.75	.....	3.70	4.7	6.05	4.20	3.00	3.81	3.69	3.10	4.05	4.30
30	3.75	.....	3.70	4.7	6.10	4.20	3.00	3.80	3.68	3.14	4.10	4.25
31	3.80	.....	3.70	.....	6.10	.....	3.00	3.79	.....	3.16	.....	4.25
1908.												
1	4.25	3.35	3.35	4.50	5.00	5.20	5.10	3.88	3.29	3.50	3.48	3.75
2	4.20	3.35	3.35	4.40	5.10	5.10	5.55	3.90	3.29	3.48	3.50	3.71
3	4.20	3.40	3.30	4.30	5.20	5.10	5.55	3.85	3.28	3.44	3.50	3.68
4	4.15	3.40	3.35	4.20	5.20	5.10	5.50	3.85	3.28	3.40	3.30	3.65
5	4.10	3.45	3.35	4.10	5.20	5.10	4.80	3.93	3.27	3.38	3.12	3.61
6	4.05	3.35	3.35	4.10	5.20	5.10	4.65	3.90	3.26	3.37	3.14	3.61
7	4.00	3.40	3.30	4.20	4.80	5.20	4.70	3.92	3.25	3.37	3.12	3.60
8	4.00	3.45	3.30	4.15	5.00	5.90	4.70	3.88	3.23	3.35	3.15	3.58
9	3.90	3.45	3.25	4.10	5.10	6.25	4.65	3.86	3.70	3.30	3.16	3.56
10	3.85	3.45	3.25	4.05	5.15	6.40	4.65	3.95	3.77	3.25	3.17	3.56
11	3.85	3.40	3.30	4.00	5.15	6.65	4.70	3.90	3.76	3.25	3.17	3.55
12	3.80	3.45	3.30	4.05	5.15	6.80	4.70	3.94	3.78	3.23	3.16	3.57
13	3.80	3.40	3.60	4.10	5.00	6.60	4.67	3.89	4.50	3.21	3.16	3.57
14	3.75	3.40	4.00	4.15	4.90	6.50	4.65	3.95	4.45	3.25	3.16	3.60
15	3.70	3.45	4.30	4.20	4.90	6.40	4.60	3.70	4.40	3.26	3.16	3.58
16	3.65	3.50	5.10	4.25	4.95	6.35	5.10	3.68	4.25	3.26	3.16	3.57
17	3.70	3.40	5.55	4.40	4.85	5.90	4.80	3.71	4.15	3.26	3.20	3.57
18	3.70	3.35	5.60	4.60	4.75	5.90	4.72	3.88	4.05	3.16	3.19	3.55
19	3.75	3.35	5.55	4.90	4.50	5.85	4.35	3.90	3.99	3.14	3.20	3.53
20	3.80	3.35	5.45	5.20	4.20	4.80	4.32	3.91	3.90	3.12	3.20	3.53
21	3.75	3.30	5.35	5.35	4.25	4.60	4.10	3.90	3.89	3.11	4.05	3.52
22	3.70	3.30	5.25	5.45	4.30	4.40	4.05	3.90	3.78	3.10	4.05	3.52
23	3.65	3.35	5.20	5.45	4.05	4.40	3.85	3.90	3.72	3.10	4.05	3.53
24	3.60	3.35	5.25	5.40	4.20	4.45	3.93	3.90	3.62	3.09	4.03	3.53
25	3.55	3.30	5.25	5.40	4.40	4.60	3.95	3.89	3.60	3.08	4.00	3.55
26	3.50	3.35	5.20	5.30	4.70	4.80	3.90	3.92	3.58	3.08	3.95	3.60
27	3.50	3.35	5.00	5.20	4.60	5.05	3.90	3.75	3.56	3.08	3.95	3.65
28	3.45	3.30	4.85	5.15	4.80	5.05	3.92	3.50	3.52	3.30	3.90	3.70
29	3.40	3.35	4.75	5.05	4.90	5.00	3.90	3.60	3.50	3.30	3.85	3.68
30	3.40	.....	4.70	5.00	4.85	5.00	3.90	3.30	2.70	3.31	3.80	3.68
31	3.40	.....	4.65	.....	4.90	.....	3.90	3.30	.....	3.40	.....	3.65

Rating table for Kachess River near Easton, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	12	3.70	164	4.70	442	5.70	830
2.80	16	3.80	188	4.80	475	5.80	880
2.90	21	3.90	214	4.90	510	5.90	930
3.00	29	4.00	240	5.00	545	6.00	980
3.10	42	4.10	266	5.10	580	6.20	1,090
3.20	58	4.20	294	5.20	615	6.40	1,200
3.30	76	4.30	322	5.30	655	6.60	1,320
3.40	96	4.40	350	5.40	695	6.80	1,440
3.50	118	4.50	380	5.50	735		
3.60	140	4.60	410	5.60	780		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 29 discharge measurements made during 1903–1908, and is well defined.

Above gage height 3.5 feet the table is the same as the 1906 table.

Monthly discharge of Kachess River near Easton, Wash., for 1905 to 1908.

[Drainage area, 63 square miles.]

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Natural.	Mean.	Mean per square mile.		
1905.										
October	310	130	257	15,800	+3,510	19,300	314	4.98	5.74	B.
November	258	154	192	11,420	−2,460	8,960	151	2.40	2.68	B.
December	193	130	161	9,900	+2,820	12,700	207	3.29	3.79	B.
1906.										
January	280	140	173	10,600	+3,190	13,800	224	3.56	4.10	B.
February	294	214	263	14,600	− 714	13,900	250	3.97	4.13	B.
March	266	176	206	12,700	−1,590	11,100	181	2.87	3.31	B.
April	695	227	434	25,800	+7,340	33,100	556	8.83	9.85	A.
May	735	140	401	24,700	+7,110	31,800	517	8.21	9.46	A.
June	410	214	325	19,300	− 184	19,100	321	5.10	5.69	A.
July	322	71	211	13,000	−7,830	5,170	84.1	1.33	1.53	B.
August	176	62	131	8,060	−6,610	1,450	23.6	.375	.43	B.
September	140	62	92.8	5,520	−3,350	2,170	36.5	.579	.65	B.
October	475	62	168	10,300	+6,900	17,200	280	4.44	5.12	B.
November	2,300	62	798	47,500	+5,580	53,100	892	14.16	15.80	A.
December	580	240	337	20,700	−7,540	13,200	215	3.41	3.93	A.
The year	2,300	62	295	213,000	+2,300	215,000	298	4.74	64.00	
1907.										
January	253	176	202	12,400	−1,240	11,200	182	2.89	3.33	B.
February	410	201	303	16,800	+2,130	18,900	340	5.40	5.62	B.
March	308	164	229	14,100	−3,020	11,100	181	2.87	3.31	A.
April	458	164	301	17,900	+4,980	22,900	385	6.11	6.82	A.
May	1,090	442	831	51,100	+6,510	57,600	937	14.87	17.24	A.
June	1,040	42	384	22,800	+5,140	27,900	469	7.44	8.30	A.
July	294	29	143	8,790	−1,470	7,320	119	1.89	2.18	A.
August	272	29	123	7,560	−5,530	2,030	33.0	.524	.60	A.
September	183	159	170	10,100	−7,440	2,660	44.7	.710	.79	A.
October	230	42	111	6,820	−5,640	1,180	19.2	.305	.35	A.
November	266	54	113	6,720	+3,450	10,200	171	2.71	3.02	A.
December	322	176	226	13,900	+1,770	15,700	255	4.05	4.67	A.
The year	1,090	29	261	189,000	− 354	189,000	261	4.15	56.23	
1908.										
January	308	96	185	11,400	−3,890	7,510	122	1.94	2.24	B.
February	118	76	92.5	5,320	− 351	4,970	86.4	1.37	1.48	A.
March	780	76	368	22,600	+6,380	29,000	472	7.49	8.64	A.
April	715	240	432	25,700	+2,150	27,800	467	7.41	8.27	A.
May	615	253	486	29,900	+8,000	37,900	616	9.78	11.28	A.
June	1,440	350	764	45,500	+ 368	45,900	771	12.24	13.66	A.
July	758	201	395	24,300	− 478	23,800	387	6.14	7.08	A.
August	227	76	193	11,900	−7,920	3,980	64.7	1.03	1.19	A.
September	380	12	167	9,940	−7,860	2,080	35.0	.556	.62	B.
October	118	39	69.5	4,270	− 632	3,640	59.2	.940	1.08	B.
November	253	45	119	7,080	+2,360	9,440	159	2.52	2.81	B.
December	176	122	140	8,610	− 956	7,650	124	1.97	2.27	A.
The year	1,440	12	284	207,000	−2,830	204,000	280	4.45	60.62	

NORTH FORK OF CLEALUM RIVER AT GALENA, WASH.

This station, which was established June 16, 1907, is located at Galena post-office, just below the mouth of Camp Creek, 1 mile above the mouth of Boulder Creek and 5 miles above the junction of North and Middle forks of Clealum River. It is not possible with the present data to form an estimate of the flow, but the gage heights are complete for the low-water season of 1907, and it will be possible later to develop a discharge curve to which these heights can be applied.

The following measurement was made June 16, 1907:

Width, 35 feet; area, 180 square feet; gage height, 5.24 feet; discharge, 250 second-feet.

Daily gage height, in feet, of North Fork of Clealum River at Galena, Wash., for 1907.

[C. H. Homan, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.22	4.25	4.16	3.29	3.24	3.38	16	5.24	4.47	3.42	4.05	3.24	3.15	.....
2	.....	5.19	4.43	4.11	3.27	3.25	3.43	17	.....	4.45	3.41	4.04	3.24	3.15	.....
3	.....	5.14	4.41	4.03	3.25	3.25	3.51	18	.....	4.45	3.41	4.04	3.24	3.15	.....
4	.....	.....	4.35	4.01	3.25	3.24	3.64	19	.....	4.44	3.40	4.02	3.23	3.16	.....
5	.....	5.08	4.21	4.00	3.26	3.24	3.72	20	.....	4.43	3.40	4.00	3.23	3.17	.....
6	.....	5.08	4.08	4.00	3.26	3.23	3.85	21	.....	4.44	3.39	3.45	3.22	3.17	.....
7	.....	5.08	4.05	3.49	3.27	3.21	4.03	22	.....	4.42	3.39	3.40	3.21	3.17	.....
8	.....	5.09	4.04	3.48	3.27	3.19	4.21	23	.....	4.39	3.38	3.33	3.19	3.18	.....
9	.....	5.11	4.03	3.48	3.27	3.18	.....	24	.....	4.35	4.15	3.33	3.19	3.18	.....
10	.....	5.15	4.01	3.47	3.26	3.17	.....	25	6.00	4.32	4.29	3.32	3.18	3.19	.....
11	.....	5.13	3.49	4.00	3.25	3.17	.....	26	6.31	4.30	4.28	3.32	3.18	3.20	.....
12	.....	5.13	3.48	4.03	3.25	3.16	.....	27	6.03	4.29	4.16	3.32	3.18	3.24	.....
13	.....	5.09	3.47	3.45	3.24	3.16	.....	28	5.46	4.27	3.43	3.31	3.19	3.28	.....
14	.....	5.07	3.45	3.44	3.24	3.15	.....	29	5.32	4.27	3.42	3.31	3.21	3.30	.....
15	.....	5.01	3.43	4.02	3.24	3.15	.....	30	5.25	4.27	3.42	3.30	3.23	3.34	.....
								31	.....	4.25	3.45	.....	3.24	.....	.....

CLEALUM LAKE NEAR ROSLYN, WASH.

Observations of the height of Clealum Lake were begun January 25, 1906. Four gages have been used at this point:

Gage No. 1 was in operation January 25 to March 31, 1906. On the later date this gage was washed away by waves during a storm on the lake. As the gage was not referred to any bench mark and the datum is lost for that period, the heights reported are not comparable with subsequent records.

Gage No. 2 was installed May 4, 1906. It is located above the outlet of the lake and indicates the true height of the water surface of the lake.

Gage No. 3, which was installed June 17, 1907, is attached to the abutment of the dam located about 200 feet below the outlet of the lake. The zero of this gage coincides with the top of the sill on the bottom of the outlet tunnels in the dam. It was expected that when water was stored the natural fall between the outlet and the dam would be obliterated and the gage readings on Nos. 2 and 3 would then be comparable.

Gage No. 4 is a stilling box gage installed November 9, 1907, at the same datum and locality as No. 3. The datum of the gage No. 2 is 0.45 foot below the datum of gage No. 3, and it was the intention to correct all previous heights observed on gage No. 2 to the datum of gage No. 3. Since gage No. 3 was installed the records on No. 2 were inadvertently suspended, except from July 7 to November 9, 1907,

when simultaneous records were kept. On March 4, 1908, the flashboards were placed in the dam and storage of water began. By March 15, 1908, the water had reached sufficient height to obliterate the natural fall of the water surface between the outlet of the lake and the dam, and although observations were taken on gage No. 3 they have been made comparable with the datum of No. 2 by correcting them +0.45 foot. This will hold until such time as the water is drawn down to about 5 feet on gage No. 3, when the fall between the outlet and the dam will again be visible. The observed heights from May 4, 1906, to June 17, 1907, and from July 7 to November 9, 1907, and the corrected heights from March 15 to December 31, 1908, are given in the first table. From June 17 to July 7, 1907, and from November 9, 1907, to March 14, 1908, the observations from gage No. 3 (or No. 4) are given in the second table. They are not comparable, except in an approximate way, with those in the first table. Simultaneous readings taken between July 7 and November 9, 1907, do not reveal a consistent relation between the two gages, as the fall is variable, depending upon the number of flashboards in place and upon the amount of water allowed to pass the dam.

The normal water surface of Clealum Lake is at an elevation of 2,130 feet, and the area of the lake is 2,200 acres at that height. The zero of gage No. 2 is 2,122.30 feet above sea level.

Daily gage height, in feet, of Clealum Lake near Roslyn, Wash., for 1906. (*Gage in lake.*)

[U. S. Reclamation Service, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 2.3					4.6				1.7	3.6	3.0
2						4.6				1.7	3.5	2.9
3						4.6				1.8	3.4	2.8
4					5.9	4.8				1.8	3.2	2.7
5					5.7	5.1				1.9	3.0	2.7
6					5.4	4.8				2.0	3.0	2.7
7					5.2	4.6				2.0	3.1	2.7
8					5.1	4.5				2.0	3.2	2.6
9					5.2	4.4				1.9	3.2	2.7
10					5.5					1.9	3.4	2.6
11					5.7					1.9	4.2	2.6
12					5.5			2.1		1.9	4.4	2.5
13					5.2			2.0		1.9	5.9	2.5
14					5.0			2.0		2.0		2.5
15					5.0					2.1		2.5
16					4.8							2.5
17					4.6						7.8	2.5
18					4.6						6.1	2.5
19					4.5			1.9			5.6	2.6
20					4.5						5.0	2.6
21					4.4					3.0	4.4	2.6
22					4.2					3.0	4.1	2.7
23					4.3					2.8	3.9	2.8
24					4.4					2.7	3.6	2.8
25					4.4					2.8	3.6	2.8
26					5.0					7.0	3.3	2.8
27					5.1					6.4	3.3	2.8
28		[a] 2.8			5.0					4.5	3.2	2.7
29					4.7						3.4	2.7
30				[a] 5.5	4.6	[a] 3.6			[a] 2.0		3.0	2.7
31	[a] 3.3		[a] 4.1		4.5		[a] 2.1	[a] 1.6		[a] 3.7		2.7

[a] Estimated, from approximate relation determined for gage height on lake and river.

Daily gage height, in feet, of Clealum Lake near Roslyn, Wash., for 1907 and 1908. (Gage in lake.)

[Albert D. Nichols, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	.....	2.5	1.7	4.9	6.4	.....	3.7	3.6	3.6	3.0	.....
2	2.7	.....	2.5	1.7	5.1	6.1	.....	3.8	3.6	3.6	3.0	.....
3	2.6	.....	2.4	1.8	5.3	5.7	.....	.....	3.6	3.6	3.0	.....
4	2.6	.....	2.4	1.8	5.7	5.5	.....	.....	3.6	3.6	3.0	.....
5	2.5	.....	2.3	1.9	6.0	5.5	.....	.....	3.6	3.6	3.0	.....
6	2.5	.....	2.2	2.0	6.1	5.3	.....	.....	3.6	3.6	3.1	.....
7	2.5	.....	2.2	2.0	6.0	5.2	.....	4.2	3.6	3.6	3.1	.....
8	2.4	.....	2.2	2.0	6.2	5.0	3.6	4.2	3.6	3.6	3.1	.....
9	2.4	.....	2.2	2.1	6.2	4.8	3.6	4.2	3.6	3.6	3.1	.....
10	2.3	4.3	2.2	2.4	6.1	4.6	3.6	4.2	3.6	3.4	.....	.....
11	2.3	4.2	2.2	2.7	5.8	4.5	3.6	4.2	3.6	3.2	.....	.....
12	2.3	4.0	2.1	2.9	5.7	4.5	3.6	4.1	3.6	3.0	.....	.....
13	2.2	3.8	2.1	3.0	5.2	4.4	3.6	4.1	3.6	2.9	.....	.....
14	2.2	3.7	2.1	4.5	5.2	4.3	3.6	.....	3.6	2.9	.....	.....
15	2.2	3.5	2.1	4.6	5.5	4.0	3.4	.....	3.6	2.9	.....	.....
16	2.2	3.3	2.1	4.8	6.4	3.8	3.4	3.9	3.6	2.9	.....	.....
17	2.1	2.7	2.0	5.1	6.7	.....	3.4	3.8	3.6	2.9	.....	.....
18	2.1	2.6	2.0	5.0	6.7	.....	3.4	3.8	3.6	2.9	.....	.....
19	2.1	2.5	1.9	4.8	6.4	.....	3.3	3.8	3.6	2.9	.....	.....
20	2.2	2.5	1.9	4.6	6.6	.....	3.2	3.8	3.6	2.9	.....	.....
21	2.3	2.6	1.9	4.5	6.0	.....	3.2	3.8	3.6	2.9	.....	.....
22	2.3	2.6	1.9	4.7	5.7	.....	3.2	3.7	3.6	2.9	.....	.....
23	2.3	2.7	1.8	5.0	5.5	.....	3.2	3.6	3.6	2.9	.....	.....
24	2.4	2.7	1.8	5.3	5.5	.....	3.2	3.6	3.6	2.9	.....	.....
25	2.5	2.8	1.7	5.4	5.5	.....	3.2	3.6	3.6	2.9	.....	.....
26	2.5	2.8	1.7	5.4	5.5	.....	3.2	3.6	3.6	2.9	.....	.....
27	2.4	2.7	1.7	5.3	5.6	.....	3.2	3.6	3.6	2.9	.....	.....
28	2.4	2.7	1.7	5.2	5.7	.....	3.3	3.7	3.6	2.9	.....	.....
29	2.4	.....	1.7	5.0	5.9	.....	3.4	3.7	3.6	2.9	.....	.....
30	2.4	.....	1.7	4.9	6.1	[a] 4.2	3.5	3.6	3.6	2.9	.....	.....
31	2.4	.....	1.7	.....	6.3	.....	3.6	3.6	.....	2.9	.....	.....
1908.[b]												
1	.....	.....	.....	12.75	13.65	14.05	14.15	12.85	10.25	6.85	6.65	12.45
2	.....	.....	.....	12.65	13.85	13.95	14.30	12.85	9.95	6.85	7.25	12.45
3	.....	.....	.....	12.65	14.25	13.95	14.02	12.85	9.25	6.85	7.55	12.35
4	.....	.....	.....	12.75	14.05	13.85	13.95	12.75	8.55	6.85	7.95	12.35
5	.....	.....	.....	12.75	14.05	13.85	13.45	12.75	8.05	6.85	8.25	12.25
6	.....	.....	.....	12.75	14.15	14.15	13.45	12.75	7.55	6.85	8.45	12.25
7	.....	.....	.....	12.75	14.45	14.45	13.45	12.75	7.25	6.85	8.55	12.25
8	.....	.....	.....	12.65	14.45	14.95	13.45	12.75	7.35	6.85	8.55	12.25
9	.....	.....	.....	12.65	14.45	15.45	13.95	12.75	7.45	6.75	8.65	12.25
10	.....	.....	.....	12.75	14.25	15.75	14.05	12.75	7.45	6.35	8.85	12.25
11	.....	.....	.....	12.85	13.95	15.75	14.15	12.75	7.45	6.35	8.95	12.25
12	.....	.....	.....	13.25	13.75	15.65	14.15	12.65	7.45	6.05	8.95	12.25
13	.....	.....	.....	13.45	13.85	15.65	14.25	12.65	7.45	5.85	9.05	12.35
14	.....	.....	.....	13.65	13.75	15.05	14.25	12.65	7.45	5.75	9.05	12.35
15	.....	.....	7.25	13.65	13.75	15.05	14.05	12.65	7.55	.....	8.95	12.35
16	.....	.....	9.95	13.65	13.95	14.95	14.55	12.65	7.45	5.95	8.95	12.35
17	.....	.....	11.85	13.65	13.95	14.75	14.35	12.65	7.45	5.95	9.05	12.35
18	.....	.....	13.05	13.85	14.05	14.45	13.95	12.65	7.45	5.95	9.55	12.25
19	.....	.....	13.45	14.45	14.25	14.15	13.75	12.65	7.45	6.15	10.85	12.25
20	.....	.....	13.05	14.65	14.25	13.95	13.65	12.65	7.35	.....	11.75	12.25
21	.....	.....	12.95	14.65	14.25	13.85	13.55	12.65	7.35	.....	12.35	12.25
22	.....	.....	12.95	14.35	14.35	13.65	13.45	12.65	7.35	.....	12.65	12.25
23	.....	.....	12.95	14.25	14.25	13.65	13.45	12.65	7.35	6.35	12.75	12.25
24	.....	.....	13.25	14.25	14.35	13.85	13.45	12.65	7.25	6.35	12.85	12.25
25	.....	.....	13.35	14.05	14.45	13.95	13.45	12.65	7.25	6.45	12.75	12.25
26	.....	.....	13.15	13.85	14.35	14.15	13.35	12.65	7.25	6.45	12.65	12.25
27	.....	.....	13.15	13.75	14.25	14.25	13.15	12.55	7.15	6.45	12.65	12.45
28	.....	.....	12.95	13.55	14.25	13.95	13.05	12.45	7.15	6.45	12.55	12.45
29	.....	.....	12.95	13.65	14.15	13.95	12.95	12.05	7.05	6.45	12.55	12.45
30	.....	.....	12.85	13.55	14.15	14.05	12.95	11.05	7.05	6.45	12.45	12.45
31	.....	.....	12.85	.....	13.95	.....	12.95	10.65	.....	6.45	.....	12.35

[a] Estimated, from approximate relation determined for gage height on lake and river.
[b] Gage heights for 1908 computed from readings on gage No. 3 by adding 0.45 foot, the difference in elevation between gages No. 2 and No. 3.

NOTE.—These gage heights refer to gage No. 2, in the lake.

Daily gage height, in feet, of Clealum Lake near Roslyn, Wash., for 1907 and 1908. (Gage at dam.)

[Albert D. Nichols, observer.]

Day.	1907.							1908.		
	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	.....	2.2	2.6	2.3	2.1	.....	3.1	3.1	2.0	2.0
2	.....	2.1	2.7	2.3	2.0	.....	3.3	3.1	1.9	2.0
3	.....	2.0	2.8	2.3	2.0	.....	3.3	3.0	1.9	2.0
4	.....	2.0	2.9	2.3	2.0	.....	3.3	3.0	1.9	1.9
5	.....	2.0	2.9	2.3	1.9	.....	3.2	3.0	2.0	2.2
6	.....	1.9	2.8	2.3	1.9	.....	3.2	2.9	2.0	2.2
7	.....	1.7	2.8	2.3	1.9	.....	3.1	2.9	2.0	2.2
8	.....	1.6	2.7	2.3	1.9	.....	3.0	2.8	2.0	2.2
9	.....	1.5	2.7	2.3	1.9	.....	2.9	2.7	2.0	2.2
10	.....	1.5	2.7	2.3	1.9	1.8	2.9	2.7	1.9	2.2
11	.....	1.6	2.7	2.3	1.9	1.8	2.9	2.6	1.9	2.2
12	.....	1.6	2.6	2.3	1.9	1.8	2.9	2.6	1.9	2.7
13	.....	1.5	3.4	2.3	1.9	1.8	2.9	2.6	1.9	3.4
14	.....	1.5	2.8	2.3	1.9	1.83	3.0	2.6	1.9	4.5
15	.....	1.4	2.8	2.2	1.9	1.83	2.8	2.6	1.9	.....
16	.....	.....	2.7	2.2	1.9	1.83	2.7	2.6	2.0	.....
17	.....	.....	2.7	2.2	1.9	1.8	2.5	2.6	1.9	.....
18	2.0	.....	2.7	2.3	1.8	1.8	2.5	2.6	1.9	.....
19	2.3	.....	2.7	2.3	1.6	1.82	2.4	2.5	1.9	.....
20	2.6	.....	2.6	2.3	1.7	1.9	2.4	2.4	1.9	.....
21	2.7	.....	2.6	2.4	1.7	2.0	2.4	2.3	1.9	.....
22	2.6	.....	2.6	2.4	1.7	2.1	2.4	2.3	1.9	.....
23	2.3	.....	2.6	2.4	1.6	2.1	2.5	2.2	1.9	.....
24	2.3	.....	2.6	2.3	1.6	2.2	2.7	2.2	1.9	.....
25	2.4	.....	2.4	2.3	1.6	2.3	2.9	2.1	1.9	.....
26	2.6	2.3	2.4	2.3	1.6	2.5	2.9	2.1	1.9	.....
27	2.7	2.3	2.4	2.2	1.6	2.5	3.0	2.1	2.0	.....
28	2.7	2.4	2.4	2.2	1.7	2.6	3.1	2.1	2.0	.....
29	2.6	2.4	2.4	2.2	1.7	2.7	3.1	2.0	2.0	.....
30	2.4	2.5	2.4	2.1	2.0	2.8	3.1	2.0	.....	.....
31	.....	2.6	2.3	.....	2.0	.....	3.1	2.0	.....	.....

NOTE.—These gage heights refer to gages Nos. 3 and 4, at the dam, the datum of which is 0.45 above that of gage No. 2. For purposes of computing storage, the fall between the gages has been assumed to be 0.85 November 10, 1907, to March 14, 1908.

Table showing volume of storage on Clealum Lake near Roslyn, Wash., for 1906 to 1908.

Gage height.	Storage.	Gage height.	Storage.	Gage height.	Storage.
Feet.	*Acre-feet.*	*Feet.*	*Acre-feet.*	*Feet.*	*Acre-feet.*
1.00	1,980	5.00	10,220	9.00	18,990
2.00	3,990	6.00	12,360	10.00	21,270
3.00	6,030	7.00	14,540	11.00	23,580
4.00	8,110	8.00	16,750	12.00	25,920

NOTE.—This table is for gage No. 2, on the lake.

CLEALUM RIVER NEAR ROSLYN, WASH.

This station, which was established October 10, 1903, is located at the outlet of Clealum Lake, which is to be utilized for storage by the United States Reclamation Service.

The data obtained are of great value in connection with the development of irrigation in the Yakima Valley, and particularly in determining the economic storage capacity of this area.

The conditions at the station are favorable for good results, and a permanent rating curve has been developed. There was a little dead water at low stages, but this difficulty has been removed by relocation of the cable on August 20, 1908, about 500 feet below the former site. The datum of the gage has remained constant since the station was established. Ice does not interfere with the determination of flow during the winter months.

During the winter of 1907 the Reclamation Service completed a temporary timber dam for storage. The outflow of the lake is therefore under artificial control.

Before the dam was constructed the lake was used for storage by the Cascade Lumber Company, and the flow during the summer months was therefore partially under control, although the dam was of temporary construction and was replaced each season.

Discharge measurements of Clealum River near Roslyn, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	H. D. McGlashan	121	701	2.11	422
May 20	do	152	1,290	6.50	3,870
October 30 [a]	do	77	94	1.02	110
1908.					
July 20	Allen and Gleason	131	938	4.20	1,660
August 18	C. F. Gleason	124	660	2.29	525
August 20 [b]	do	132	356	2.26	496
September 7 [b]	Allen and Gleason	132	418	2.87	728
Do. [b]	do	132	418	2.87	[c] 677
September 19 [b]	C. F. Gleason	126	261	1.55	256
November 18 [b]	L. R. Allen	126	268	1.51	[c] 236

[a] Measured by wading.
[b] Measured at new section, 500 feet below old one.
[c] Made with defective meter; discarded.

Daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1907 and 1908.

[Albert D. Nichols, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.4	.....	2.8	2.0	4.2	6.9	3.9	2.0	1.7	1.5	1.1	2.6
2	2.4	.....	2.8	2.0	4.3	6.4	3.7	2.1	1.7	1.5	1.2	2.7
3	2.3	.....	2.7	2.1	4.6	5.9	3.6	2.2	1.7	1.5	1.2	2.7
4	2.3	.....	2.7	2.1	5.0	5.7	3.6	2.0	1.7	1.4	1.3	2.7
5	2.2	.....	2.6	2.2	5.4	5.7	3.6	2.1	1.7	1.4	1.3	2.6
6	2.2	.....	2.5	2.3	6.4	5.5	3.5	2.1	1.7	1.4	1.3	2.5
7	2.2	.....	2.5	2.3	6.3	5.2	3.3	2.1	1.7	1.4	1.3	2.5
8	2.1	.....	2.5	2.3	6.4	5.0	3.2	2.1	1.7	1.4	1.3	2.4
9	2.1	.....	2.5	2.4	6.6	4.8	3.1	2.1	1.7	1.4	1.3	2.4
10	2.0	4.0	2.5	2.7	6.3	4.5	3.1	2.0	1.7	1.4	1.3	2.4
11	2.0	3.8	2.5	3.0	6.1	4.4	3.2	2.0	1.7	1.4	1.3	2.2
12	2.0	3.7	2.4	3.2	5.7	4.5	3.2	1.9	1.7	1.4	1.3	2.2
13	1.9	3.5	2.4	3.3	5.4	4.3	3.1	1.4	1.7	1.3	1.3	2.2
14	1.9	3.4	2.4	3.6	5.3	4.1	3.1	1.9	1.7	1.3	1.3	2.2
15	1.9	3.2	2.4	3.8	6.1	3.8	3.0	1.8	1.7	1.3	1.3	2.2
16	1.9	3.1	2.4	4.0	6.9	3.6	2.9	1.8	1.7	1.3	1.3	2.1
17	1.8	3.0	2.3	4.2	6.9	3.6	2.9	1.8	1.7	1.3	1.3	2.1
18	1.8	2.9	2.3	4.1	7.0	3.7	2.8	1.8	1.7	1.2	1.3	2.0
19	1.8	2.8	2.2	3.9	6.8	4.0	2.8	1.7	1.7	1.1	1.3	2.0
20	1.9	2.8	2.2	3.7	6.7	4.3	2.7	1.7	1.8	1.1	1.4	1.9

Daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	2.0	2.9	2.2	3.7	6.2	4.3	2.7	1.7	1.8	1.1	1.4	1.9
22	2.0	2.9	2.2	3.9	5.9	4.2	2.6	1.7	1.7	1.1	1.5	1.9
23	2.0	3.0	2.1	4.3	5.4	3.9	2.6	1.7	1.7	1.1	1.7	2.0
24	2.2	3.0	2.1	4.5	5.8	3.9	2.5	1.7	1.7	1.1	1.8	2.1
25	2.2	3.1	2.0	4.6	5.8	4.0	2.4	1.7	1.7	1.1	1.8	2.2
26	2.2	3.1	2.0	4.6	5.7	4.2	2.3	1.8	1.6	1.1	1.9	2.3
27	2.2	3.0	2.0	4.5	5.8	4.4	2.2	1.8	1.6	1.1	1.9	2.3
28	2.2	3.0	2.0	4.4	6.1	4.4	2.2	1.8	1.6	1.1	2.0	2.3
29	2.2	.....	2.0	4.1	6.4	4.3	2.2	1.8	1.6	1.1	2.0	2.3
30	2.3	.....	2.0	4.1	6.6	4.0	2.1	1.8	1.5	1.0	2.1	2.3
31	2.4	.....	2.0	.....	6.8	.....	2.0	1.7	.....	1.0	.....	2.3
1908.												
1	2.2	1.5	1.5	2.7	4.5	4.8	5.3	2.6	3.1	1.4	1.7	2.1
2	2.2	1.4	1.5	2.6	4.8	4.8	5.9	2.6	3.0	1.4	1.8	2.0
3	2.2	1.4	1.5	2.7	5.1	4.7	6.0	2.6	3.2	1.4	1.5	1.9
4	2.2	1.4	1.5	2.7	4.9	4.8	5.7	2.5	3.2	1.4	1.5	1.9
5	2.2	1.4	1.5	2.7	4.9	5.0	5.0	2.5	3.1	1.4	1.5	1.8
6	2.1	1.5	1.5	2.6	5.0	5.3	4.7	2.5	3.0	1.5	1.5	1.8
7	2.1	1.5	1.5	2.4	5.4	5.8	4.7	2.5	2.9	1.5	1.5	1.7
8	2.0	1.5	1.4	2.5	5.8	6.5	4.6	2.5	1.6	.9	1.5	1.6
9	2.0	1.5	1.4	2.6	5.5	7.3	4.5	2.4	1.6	1.7	1.5	1.6
10	2.0	1.4	1.4	2.8	5.0	7.6	4.7	2.4	1.6	2.0	1.5	1.6
11	2.0	1.4	1.5	2.9	4.8	7.7	4.8	2.3	1.6	1.9	1.5	1.6
12	1.9	1.4	1.4	3.5	4.5	7.5	4.8	2.3	1.6	2.1	1.5	1.7
13	1.9	1.4	1.4	3.9	4.4	7.0	4.9	2.3	1.6	2.0	1.5	1.8
14	1.9	1.4	1.8	4.1	4.3	6.7	4.9	2.3	1.6	2.0	1.5	1.9
15	1.9	1.4	1.5	4.3	4.4	6.7	4.8	2.2	1.6	.....	1.5	1.8
16	1.8	1.4	1.7	4.0	4.7	6.4	5.2	2.2	1.6	1.8	1.5	1.8
17	1.8	1.4	3.0	4.1	4.8	5.8	5.3	2.2	1.6	1.7	1.5	1.8
18	1.8	1.4	3.8	4.7	5.0	5.4	4.8	2.3	1.6	1.7	1.5	1.7
19	1.8	1.4	4.0	5.7	5.2	5.0	4.4	2.2	1.5	1.5	1.5	1.7
20	1.8	1.4	3.7	6.2	5.2	4.8	4.1	2.2	1.5	.....	1.7	1.6
21	1.7	1.4	3.5	6.1	5.2	4.4	4.0	2.2	1.5	.....	2.4	1.6
22	1.7	1.4	3.3	5.5	5.2	4.1	3.9	2.2	1.5	.....	2.9	1.5
23	1.7	1.4	3.3	5.2	5.4	4.1	3.9	2.2	1.5	1.1	3.1	1.6
24	1.7	1.4	3.5	5.0	5.6	4.6	3.9	2.2	1.5	1.1	3.0	1.7
25	1.7	1.4	3.7	4.9	5.8	4.8	3.8	2.2	1.5	1.0	2.8	1.7
26	1.6	1.4	3.6	4.4	5.7	5.3	3.5	2.1	1.4	1.0	2.7	1.7
27	1.6	1.5	3.4	4.3	5.3	5.3	3.3	2.0	1.4	1.0	2.5	1.9
28	1.6	1.5	3.3	4.1	5.3	4.8	3.0	2.5	1.4	1.0	2.4	2.0
29	1.6	1.5	3.0	4.1	5.4	4.5	2.9	3.1	1.4	1.0	2.3	2.1
30	1.6	.....	2.9	4.0	5.3	4.7	2.8	3.3	1.4	1.5	2.2	1.9
31	1.6	.....	2.8	.....	4.8	.....	2.7	3.2	.....	1.5	.....	1.8

Rating table for Clealum River near Roslyn, Wash., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	84	2.30	495	3.70	1,170	6.20	3,440
1.00	106	2.40	530	3.80	1,230	6.40	3,680
1.10	130	2.50	570	3.90	1,295	6.60	3,920
1.20	154	2.60	610	4.00	1,360	6.80	4,160
1.30	180	2.70	650	4.20	1,500	7.00	4,400
1.40	208	2.80	695	4.40	1,640	8.00	5,800
1.50	236	2.90	740	4.60	1,800	9.00	7,340
1.60	265	3.00	785	4.80	1,970	10.00	9,040
1.70	296	3.10	835	5.00	2,150	11.00	10,900
1.80	328	3.20	885	5.20	2,350	12.00	12,940
1.90	360	3.30	940	5.40	2,550	13.00	15,200
2.00	392	3.40	995	5.60	2,760	14.00	17,700
2.10	425	3.50	1,050	5.80	2,980		
2.20	460	3.60	1,110	6.00	3,200		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 32 discharge measurements made during 1903–1908 and is well defined between gage heights 1.0 foot and 7.0 feet.

Monthly discharge of Clealum River near Roslyn, Wash., for 1906 to 1908.

[Drainage area, 205 square miles.]

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Natural discharge in second-feet.		Run-off; depth in inches on drainage area.	Accuracy.
	Maximum.	Minimum.	Mean	Observed.	Stored.	Natural.	Mean.	Mean per square mile.		
1906.[a]										
January	785	296	401	24,700	+ 2,050	26,800	436	2.13	2.46	B.
February	885	460	644	35,800	− 1,030	34,800	627	3.06	3.19	B.
March	995	328	1,494	30,400	+ 2,700	33,100	538	2.62	3.02	A.
April	3,320	1,170	1,800	107,000	+ 2,970	110,000	1,850	9.02	10.06	A.
May	3,320	1,170	2,020	124,000	− 2,120	122,000	1,980	9.66	11.14	A.
June[b]	1,970	.....	1,230	73,200	− 1,890	71,300	1,200	5.85	6.53	B.
July[b]	.....	392	675	41,500	− 3,080	38,400	625	3.05	3.52	B.
August[b]	392	130	318	19,600	− 1,010	18,600	302	1.47	1.70	B.
September	360	265	289	17,200	+ 804	18,000	302	1.47	1.64	B.
October	4,040	296	831	51,100	+ 3,500	54,600	888	4.33	4.99	A.
November	17,700	650	2,650	158,000	− 1,460	157,000	2,640	12.88	14.37	B.
December	650	460	522	32,100	− 612	31,500	512	2.50	2.88	A.
The year	17,700	130	990	715,000	+ 816	716,000	992	4.84	65.50	
1907.										
January	530	328	426	26,200	− 612	25,600	416	2.06	2.38	B.
February[c]	1,360	.....	726	40,300	+ 612	40,900	736	3.59	3.74	B.
March	695	392	509	31,300	− 2,030	29,300	477	2.33	2.69	A.
April	1,800	392	1,070	63,700	+ 6,620	70,300	1,180	5.76	6.43	A.
May	4,400	1,500	3,210	197,000	+ 3,000	200,000	3,250	15.85	18.27	A.
June	4,280	1,110	1,880	112,000	− 4,480	108,000	1,820	8.88	9.91	A.
July	1,300	392	766	47,100	− 1,250	45,800	745	3.63	4.18	A.
August	460	296	349	21,500	0	21,500	350	1.71	1.97	C.
September	328	236	292	17,400	0	17,400	292	1.42	1.58	C.
October	236	106	170	10,500	− 1,450	9,050	147	.717	.83	B.
November	425	130	228	13,600	+ 2,500	16,100	271	1.32	1.47	B.
December	650	360	489	30,100	+ 628	30,700	499	2.43	2.80	A.
The year	4,400	106	843	611,000	+ 3,540	615,000	849	4.14	56.25	
1908.										
January	460	265	351	21,600	− 2,300	19,300	314	1.53	1.76	B.
February	236	208	216	12,400	0	12,400	216	1.05	1.13	B.
March	1,360	208	605	37,200	+21,300	58,500	951	4.64	5.35	A.
April	3,440	530	1,430	85,100	+ 1,680	86,800	1,460	7.12	7.94	A.
May	2,980	1,570	2,240	138,000	+ 968	139,000	2,260	11.02	12.70	A.
June	5,380	1,430	2,810	167,000	+ 242	167,000	2,810	13.71	15.30	A.
July	3,200	650	1,750	108,000	− 2,650	105,000	1,710	8.34	9.62	C.
August	940	392	544	33,400	− 5,411	28,000	455	2.22	2.56	C.
September	885	208	379	22,600	− 8,120	14,500	244	1.19	1.33	B.
October	425	84	232	14,300	− 1,310	13,000	211	1.03	1.19	B.
November	835	236	374	22,300	+13,700	36,000	605	2.95	3.29	B.
December	425	236	319	19,600	− 236	19,400	316	1.54	1.78	B.
The year	5,380	84	937	681,000	+17,800	699,000	962	4.69	63.95	

[a] Discharges have been recomputed for gage heights of less than 2.1 feet, using the 1907–8 table. These values supersede those given in W. S. P. 214, p. 56.

[b] Discharges have been interpolated from June 10 to July 17, inclusive, and from July 19 to August 4, for days on which gage was not read.

[c] Mean discharge for February 1 to 9 has been estimated at 400 second-feet, by comparison with other stations and considering the rise of Clealum Lake. The flow during August and September, 1907, and during July and August, 1908, is too high, as the dam at the outlet of Lake Clealum was under construction and repair. The water was usually shut off during a part of each twenty-four hours on working days.

NACHES RIVER NEAR NILE, WASH.

Naches River rises in the western part of Kittitas County, Wash., and flows southeastward into the Yakima above the town of North Yakima. It is about 50 miles long and receives the drainage from a strip of the eastern slope of the Cascade Range extending from Green Pass southward for about 50 miles. It has a number of tributaries,

among which may be mentioned Bumping River, Rattlesnake Creek, Tieton River, and Cowiche Creek. Of these the Tieton is the most important. The headwater streams drain a very mountainous country (Pl. V, *A* and *B*).

This station, which was established June 25, 1904, is located $1\frac{3}{4}$ miles above the mouth of Tieton River, and one-half mile above the headgate of the Selah Valley canal, the highest diversion from Naches River.

The records of flow obtained at this station are of considerable value, in connection with the irrigation projects in the valley. The waters of the river are entirely used for irrigation during the summer months. The United States Reclamation Service proposes to divert the entire flow of Tieton River and replace this amount by constructing a storage reservoir at Bumping Lake on the headwaters of the Naches, and the station data are necessary to facilitate the intelligent and economical distribution of storage waters.

The gage was destroyed by the flood of November 15, 1906, but it was replaced at the same datum on January 28, 1907. The gage datum has not been changed since the station was installed, although changes in the stream bed have made it necessary to revise the rating curve at various times. During the winter months the river is frequently icebound, although no ice gorges form so as to affect the gage heights at the station. Anchor ice frequently forms in the bed of the stream and the water freezes over in the quieter portions of the gaging section. The records of winter flow, therefore, are not as reliable as could be desired, and where they have affected the results due allowances have been made.

Discharge measurements of Naches River near Nile, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 29 [a]	W. C. Muldrow	180	276	3.34	594
March 6	do	193	438	3.80	1,260
March 22	McGlashan and Muldrow	189	335	3.50	981
May 6	H. D. McGlashan	202	695	5.50	3,850
June 23	Stevens and McGlashan	194	410	4.35	1,780
August 19	H. D. McGlashan	186	171	2.91	355
September 27	J. C. Stevens	182	147	2.80	255
October 25	H. D. McGlashan	181	126	2.68	192
1908.					
April 20	H. D. McGlashan	202	799	6.25	6,180
July 16	Allen and Gleason	198	502	4.88	2,760
August 12	C. F. Gleason	173	160	3.46	530
August 29	do	164	139	3.35	418
September 18	L. R. Allen	156	110	3.09	266
November 12	Allen and Gleason	161	137	3.23	357

[a] River frozen along edges and ice running.

GLACIERS (IN AUGUST) AT THE HEADWATERS OF SOUTH FORK OF TIETON RIVER, WASHINGTON.

Daily gage height, in feet, of Naches River near Nile, Wash., for 1907 and 1908.

[W. H. Johnson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	3.48	3.50	4.10	3.45	4.80	6.02	4.30	3.20	2.90	2.80	2.75	3.70
2	3.35	3.40	4.00	3.50	4.90	5.88	4.30	3.20	3.00	2.80	2.75	3.50
3	3.35	3.40	4.00	3.50	5.00	5.69	4.30	3.20	3.00	2.80	2.80	3.40
4	3.35	3.30	3.90	3.60	5.20	5.54	4.30	3.20	3.00	2.80	2.80	3.40
5	3.22	3.66	3.90	3.60	5.30	5.40	4.20	3.10	3.00	2.80	2.80	3.30
6	3.35	3.65	3.80	3.60	5.50	5.30	4.10	3.10	2.90	2.80	2.80	3.30
7	3.22	4.10	3.80	3.60	5.67	5.20	4.00	3.10	2.90	2.70	2.80	3.30
8	3.22	4.45	3.80	3.70	5.81	5.10	4.00	3.10	2.90	2.70	2.80	3.20
9	3.22	4.65	3.80	3.80	5.97	5.00	3.90	3.10	2.90	2.70	2.75	3.10
10	3.09	4.50	3.80	4.20	5.95	4.90	3.90	3.10	2.90	2.70	2.75	3.10
11	3.09	4.30	3.80	4.30	5.78	4.90	3.90	3.10	2.80	2.70	2.75	3.10
12	3.09	4.20	3.70	4.30	5.62	4.90	3.80	3.10	2.80	2.70	2.75	3.10
13	3.09	4.10	3.70	4.40	5.45	4.80	3.80	3.00	2.80	2.70	2.70	3.10
14	2.96	4.10	3.70	4.70	5.30	4.60	3.70	3.00	2.80	2.70	2.70	3.00
15	2.96	4.00	3.70	4.80	5.40	4.40	3.70	3.00	2.80	2.70	2.70	3.00
16	2.96	4.00	3.60	5.00	5.88	4.40	3.60	3.00	2.90	2.70	2.70	3.00
17	2.96	3.90	3.60	4.90	6.11	4.30	3.60	3.00	3.00	2.70	2.70	3.00
18	3.09	3.90	3.60	4.70	6.22	4.40	3.60	3.00	3.00	2.70	2.70	3.00
19	3.09	3.90	3.60	4.60	6.18	4.60	3.60	3.00	3.00	2.70	2.70	2.90
20	3.22	4.00	3.70	4.60	6.02	4.70	3.50	2.90	3.00	2.70	2.80	2.90
21	3.35	4.10	3.60	4.70	5.88	4.70	3.50	2.90	2.90	2.70	2.80	2.90
22	3.35	4.20	3.60	5.00	5.69	4.60	3.50	2.90	2.90	2.70	2.80	3.10
23	3.35	4.20	3.50	5.30	5.58	4.50	3.40	2.90	2.90	2.65	2.80	3.20
24	3.35	4.10	3.50	5.20	5.45	4.40	3.40	2.90	2.90	2.65	3.00	3.60
25	3.22	4.30	3.50	5.10	5.30	4.50	3.40	3.00	2.80	2.70	3.05	3.60
26	3.22	4.30	3.40	5.10	5.30	4.50	3.30	3.00	2.80	2.70	3.20	3.60
27	3.09	4.20	3.40	5.00	5.40	4.60	3.30	3.00	2.80	2.70	3.20	3.50
28	3.09	4.20	3.40	4.80	5.40	4.60	3.30	2.90	2.80	2.70	3.10	3.40
29	3.40	.....	3.40	4.70	5.58	4.50	3.20	2.90	2.80	2.70	3.30	3.30
30	3.40	.....	3.40	4.70	5.73	4.40	3.20	2.90	2.80	2.70	3.80	3.30
31	3.40	.....	3.42	.....	5.92	.....	3.20	2.90	.....	2.75	.....	3.30
1908.[b]												
1	3.2	2.8	3.0	3.7	5.0	4.7	5.3	3.8	3.3	3.0	3.5	3.5
2	3.2	2.8	2.9	3.7	5.1	4.7	5.5	3.8	3.25	3.0	3.6	3.4
3	3.2	2.8	2.9	3.8	5.2	4.6	5.6	3.8	3.25	3.0	3.7	3.4
4	3.2	2.8	2.9	3.8	5.1	4.7	5.5	3.7	3.2	3.05	3.7	3.4
5	3.1	2.9	2.9	3.7	5.0	4.8	5.3	3.7	3.2	3.05	3.6	3.3
6	3.1	3.1	2.9	3.7	5.0	4.9	5.1	3.7	3.2	3.05	3.5	3.3
7	3.1	3.1	2.9	3.6	5.2	5.1	5.0	3.6	3.2	3.05	3.45	3.3
8	3.1	3.1	2.9	3.6	5.3	5.4	5.1	3.6	3.2	3.0	3.4	3.3
9	3.1	3.0	2.9	3.7	5.2	5.7	5.2	3.6	3.2	3.0	3.35	3.3
10	3.0	3.0	2.9	3.9	5.0	6.1	5.2	3.6	3.2	3.0	3.3	3.3
11	3.0	2.9	3.0	4.0	4.9	6.2	5.1	3.5	3.15	3.0	3.3	3.25
12	3.0	2.9	3.1	4.3	4.8	6.3	5.0	3.5	3.15	3.0	3.25	3.25
13	3.0	2.9	3.5	4.5	4.7	6.1	5.0	3.5	3.15	3.0	3.25	3.3
14	3.0	2.8	4.3	4.7	4.6	6.0	5.1	3.5	3.15	3.1	3.2	3.3
15	3.0	2.8	4.4	4.8	4.7	6.0	5.0	3.5	3.1	3.2	3.2	3.3
16	3.1	2.9	5.3	4.8	4.8	5.9	4.9	3.5	3.1	3.2	3.2	3.3
17	3.1	2.9	5.1	4.8	4.7	5.7	4.8	3.4	3.1	3.2	3.3	3.2
18	3.1	2.9	4.7	5.1	4.7	5.5	4.7	3.4	3.1	3.2	3.65	3.2
19	3.0	2.9	4.4	5.7	4.8	5.3	4.6	3.4	3.1	3.2	4.0	3.1
20	3.0	2.9	4.2	6.2	4.8	5.1	4.5	3.4	3.1	3.15	4.0	3.1
21	3.0	2.8	4.1	6.0	4.9	5.0	4.5	3.4	3.1	3.15	4.0	3.2
22	3.1	2.8	4.0	5.7	4.9	4.9	4.4	3.4	3.1	3.15	3.9	3.25
23	3.1	2.8	4.0	5.4	4.8	4.8	4.4	3.4	3.05	3.1	3.9	3.3
24	3.1	2.9	4.4	5.3	5.0	4.7	4.3	3.4	3.05	3.1	3.8	3.3
25	3.1	2.9	4.3	5.1	5.1	4.8	4.2	3.3	3.05	3.1	3.7	3.4
26	3.0	2.9	4.2	4.9	5.1	5.1	4.2	3.3	3.05	3.1	3.6	3.4
27	3.0	3.0	4.0	4.8	5.0	5.2	4.1	3.3	3.05	3.1	3.6	3.5
28	2.9	3.0	4.0	4.7	5.0	5.1	4.0	3.3	3.05	3.1	3.5	3.5
29	2.9	3.0	3.9	4.7	4.9	5.0	4.0	3.3	3.05	3.1	3.5	3.4
30	2.9	.....	3.8	4.8	4.8	5.0	3.9	3.3	3.0	3.2	3.5	3.3
31	2.8	.....	3.8	.....	4.7	.....	3.9	3.3	.....	3.4	.....	3.3

[a] From January 4 to about February 10 the river was frozen one-third of the width from each bank to a maximum thickness of 8 inches. Slush ice was flowing during January.

[b] River frozen January 31 to February 4; ice reached a thickness of 6 inches.

Rating tables for Naches River near Nile, Wash.

NOVEMBER 16, 1906, TO MARCH 17, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	160	3.60	920	4.60	2,200	5.60	4,040
2.70	210	3.70	1,020	4.70	2,360	5.70	4,250
2.80	265	3.80	1,130	4.80	2,520	5.80	4,470
2.90	330	3.90	1,245	4.90	2,690	5.90	4,690
3.00	400	4.00	1,365	5.00	2,870	6.00	4,920
3.10	475	4.10	1,490	5.10	3,060	6.20	5,390
3.20	555	4.20	1,620	5.20	3,250	6.40	5,870
3.30	635	4.30	1,750	5.30	3,440		
3.40	725	4.40	1,890	5.40	3,640		
3.50	820	4.50	2,040	5.50	3,840		

MARCH 18 TO DECEMBER 31, 1908.[b]

3.00	224	3.90	1,020	4.80	2,560	5.70	4,710
3.10	274	4.00	1,160	4.90	2,780	5.80	4,970
3.20	332	4.10	1,300	5.00	3,000	5.90	5,240
3.30	398	4.20	1,450	5.10	3,230	6.00	5,510
3.40	474	4.30	1,610	5.20	3,460	6.20	6,060
3.50	562	4.40	1,780	5.30	3,700	6.40	6,620
3.60	662	4.50	1,960	5.40	3,940		
3.70	774	4.60	2,150	5.50	4,190		
3.80	894	4.70	2,350	5.60	4,450		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 10 discharge measurements made during 1906–7, and is well defined.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1908, and is fairly well defined.

Monthly discharge of Naches River near Nile, Wash., for 1906 to 1908.

[Drainage area, 636 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	840	390	513	0.807	0.93	31,500	B.
February	2,020	585	1,010	1.59	1.66	56,100	B.
March	2,380	730	996	1.57	1.81	61,200	B.
April	4,740	2,020	3,250	5.11	5.70	193,000	B.
May	4,220	1,690	2,810	4.42	5.10	173,000	B.
June	2,200	1,090	1,530	2.41	2.69	91,000	A.
July	1,090	390	676	1.06	1.22	41,600	A.
August	330	235	289	.454	.52	17,800	A.
September	330	235	267	.420	.47	15,900	A.
October	1,090	235	458	.720	.83	28,200	A.
November	21,100	460	3,620	5.69	6.35	215,000	B.
December	2,010	468	962	1.51	1.74	59,200	B.
The year	21,100	235	1,370	2.15	29.02	984,000	
1907.							
January	801	372	569	.895	1.03	35,000	B.
February	2,280	635	1,420	2.23	2.32	78,900	B.
March	1,490	725	997	1.57	1.81	61,300	B.
April	3,440	772	2,020	3.18	3.55	120,000	B.
May	5,440	2,520	4,050	6.37	7.34	249,000	A.
June	4,970	1,750	2,660	4.18	4.66	158,000	A.
July	1,750	555	1,060	1.67	1.92	65,200	A.
August	555	330	419	.659	.76	25,800	A.
September	400	265	325	.511	.57	19,300	A.
October	265	185	220	.346	.40	13,500	A.
November	1,130	210	325	.511	.57	19,300	A.
December	1,020	330	592	.931	1.07	36,400	A.
The year	5,440	185	1,220	1.92	26.00	882,000	

Monthly discharge of Naches River near Nile, Wash., for 1906 to 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	555	265	438	0.689	0.79	26,900	B.
February	475	265	337	.530	.57	19,400	B.
March	3,440	330	1,110	1.75	2.02	68,200	B.
April	6,060	662	2,350	3.70	4.13	140,000	A.
May	3,700	2,150	2,850	4.48	5.16	175,000	A.
June	6,340	2,150	3,720	5.85	6.53	221,000	A.
July	4,450	1,020	2,570	4.04	4.66	158,000	A.
August	894	398	568	.893	1.03	34,900	A.
September	398	224	294	.462	.52	17,500	B.
October	474	224	277	.436	.50	17,000	B.
November	1,160	332	642	1.01	1.13	38,200	A.
December	562	274	411	.646	.74	25,300	A.
The year	6,340	224	1,300	2.04	27.78	941,000	

NACHES RIVER NEAR NORTH YAKIMA, WASH.

This station was first established August 14, 1893, and has been maintained continuously since that date, except during the intervals when gages and gaging equipment were put out of commission by floods.

The data obtained represent the contribution of this drainage area to the flow of the Yakima after all irrigation requirements have been satisfied. The entire flow of the river during the summer months is diverted for irrigation in the Naches and Yakima valleys. The station is located below the lowest diversion for irrigation at Union Canal, one-half mile above the mouth of the river. The North Yakima power canal, however, diverts 80 to 200 second-feet past the gaging station continuously. The location of the measuring section has been changed several times. At first measurements were made at the railroad bridge; then from the highway bridge 200 feet above the railroad bridge; and still later from a cable and car between the two bridges. Gages have been maintained below the railroad bridge and on the highway bridge, and on the cribwork which extends as a protection for the approach to the railroad bridge on the right bank.

The conditions have never permitted of a permanent rating curve. The stream is subject to heavy floods, and during such times the bed, which is composed of gravel and cobblestones, changes so materially that a new rating is required after each high water. The present location of the station was chosen June 18, 1908, when a gage was installed on the right bank, 800 feet above the railroad bridge. The datum of the gage bears no determined relation to the earlier gage datums. The river at this point is spanned by a long cable reaching

from the high bluff on the left bank to an artificial dike on the right bank. At all ordinary and medium stages a permanent rating curve can be developed, but it is likely that an excessive flood will make it necessary to develop an entirely new rating curve.

During the winter months ice conditions interfere with the determination of flow to a considerable extent. The ice which forms in the river frequently jams at the railroad bridge, and during such periods it is necessary to interpolate the records of flow.

Discharge measurements of Naches River near North Yakima in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 19	W. C. Muldrow	195	706	[a] 7.27	2,300
March 1	do	200	746	[a] 7.43	2,740
March 8	do	195	689	[a] 7.16	2,150
March 21	H. D. McGlashan	188	603	[a] 6.81	1,460
March 30	do	186	565	[b] 6.50	1,190
April 30	do	205	852	[b] 8.02	4,090
June 3	do	250	1,080	[b] 8.83	[c] 6,480
August 5	do	162	208	[b] 4.72	430
August 24	do	48	84	[b] 3.72	170
September 26 [d]	J. C. Stevens	42	69	[b] 3.65	149
October 22	H. D. McGlashan	47	75	[b] 3.40	111
November 8 [d]	do	46	71	[b] 3.76	183
1908.					
April 14	H. D. McGlashan	205	756	[e] 8.40	4,210
July 12	L. R. Allen	194	760	[f] 6.00	4,320
July 22	C. F. Gleason	191	580	[f] 5.00	2,550
July 28	do	172	436	[f] 4.10	1,190
August 6	do	166	376	[f] 3.91	970
August 14	do	160	305	[f] 3.43	505
September 1	do	149	244	[f] 3.05	280
September 13 [g]	Allen and Gleason	148	223	[f] 2.90	162
Do	do	148	223	[f] 2.90	201
November 13 [g]	L. R. Allen	156	280	[f] 3.29	349

[a] From temporary staff gage.
[b] From chain gage established March 13, 1907.
[c] Partly estimated.
[d] Measured by wading.
[e] From staff gage installed December 10, 1907, 50 feet upstream from the bridge.
[f] From new gage 800 feet above railroad bridge.
[g] Measurement made with defective meter—discarded.

NOTE.—Beginning July 12, 1908, measurements were made at new section, 800 feet above railroad bridge.

Daily gage height, in feet, of Naches River near North Yakima, Wash., for 1907 and 1908.

[Mrs. A. M. Cole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	7.3	8.2	7.4	6.6	7.9	9.3	6.9	4.8	3.4	3.5	3.5	5.9
2	7.2	7.4	7.4	6.7	7.9	9.1	6.9	4.7	4.3	3.4	3.6	5.8
3	7.1	8.2	7.2	6.7	8.2	8.8	6.9	4.8	4.2	3.3	3.6	5.7
4	7.1	8.4	7.2	6.8	8.3	8.7	7.0	4.7	4.1	3.4	3.6	5.5
5	7.1	8.9	7.1	6.9	8.6	8.7	6.8	4.6	4.0	3.5	3.6	5.4
6	7.2	8.8	7.1	6.8	8.7	8.5	6.6	4.4	4.0	3.5	3.6	5.2
7	7.3	8.9	7.1	6.9	8.8	8.3	6.4	4.3	4.0	3.6	3.6	5.1
8	8.4	8.2	7.1	6.8	8.85	8.1	6.2	4.3	3.9	3.5	3.6	4.9
9	8.2	8.2	7.1	7.1	8.9	7.9	6.1	4.4	3.8	3.4	3.8	.....
10	.....	7.9	7.1	7.7	8.9	7.8	6.0	4.5	3.9	3.4	3.8	5.4

[a] Ice conditions 1907: First freeze, January 9. An ice jam formed, having a depth of 4 feet in the middle, solid 15 feet on each bank. Ice partially out January 21, but not entirely clear until about February 10. Gage covered with ice from January 10 to 21.

Daily gage height, in feet, of Naches River near North Yakima, Wash., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
11	.....	7.7	7.0	7.8	8.95	7.9	6.1	4.3	4.0	3.4	3.7	5.6
12	.....	7.6	7.0	7.9	8.8	8.0	6.15	4.2	3.9	3.4	3.7	5.6
13	.....	7.6	7.0	8.0	8.5	7.7	6.0	4.1	3.8	3.4	3.7	5.8
14	.....	7.5	6.9	8.3	8.4	7.6	6.0	4.0	3.8	3.4	3.6	5.7
15	.....	7.4	6.9	8.4	8.7	7.3	5.9	4.0	3.7	3.3	3.6	5.6
16	.....	7.3	6.8	8.4	9.3	7.1	5.7	3.9	3.8	3.3	3.7	5.5
17	.....	7.3	6.8	8.0	9.4	7.0	5.8	3.8	4.0	3.3	3.7	5.4
18	.....	7.2	6.7	7.9	9.45	7.0	5.8	3.8	4.2	3.4	3.7	5.3
19	.....	7.2	6.7	7.8	9.45	7.4	5.7	3.8	4.0	3.4	3.7	5.2
20	.....	7.4	6.8	7.7	9.2	7.6	5.4	3.6	3.9	3.4	3.8	5.3
21	9.7	7.7	6.7	7.8	8.8	7.6	5.4	3.6	3.8	3.4	3.8	5.4
22	9.7	7.7	6.7	8.2	8.6	7.4	5.3	3.8	3.7	3.4	3.9	5.8
23	9.8	7.7	6.7	8.6	8.4	7.3	5.2	3.6	3.7	3.4	4.0	6.4
24	9.1	7.6	6.8	8.7	8.4	7.1	4.9	3.5	3.7	3.3	4.2	7.3
25	8.9	7.8	6.8	8.6	8.3	7.3	4.8	3.6	3.6	3.3	4.8	7.2
26	10.0	7.7	6.7	8.5	8.4	7.5	4.8	3.8	3.6	3.3	5.1	7.1
27	10.2	7.6	6.6	8.3	8.4	7.6	4.7	3.6	3.5	3.3	4.9	6.8
28	9.7	7.5	6.5	8.1	8.5	7.5	4.9	3.4	3.5	3.3	4.8	6.6
29	9.2	.....	6.5	7.9	8.7	7.4	4.9	3.3	3.4	3.3	4.8	6.4
30	9.2	.....	6.5	7.9	8.9	7.2	4.8	3.4	3.4	3.5	6.2	6.2
31	8.7	.....	6.5	.....	9.1	.....	4.8	3.4	.....	3.6	.....	6.1
1908.												
1	6.0	5.2	5.6	7.0	8.5	8.3	6.0	3.7	3.0	2.85	3.7	3.4
2	6.0	5.2	5.5	7.0	8.8	8.3	6.4	3.7	2.95	2.9	3.7	3.35
3	5.9	5.1	5.5	7.1	8.8	8.3	6.5	3.6	3.0	2.85	3.65	3.3
4	5.8	5.0	5.5	7.1	8.7	8.2	6.3	3.7	3.0	2.8	3.65	3.3
5	5.8	5.0	5.4	7.0	8.6	8.2	6.0	3.8	2.95	2.8	3.6	3.3
6	5.8	5.0	5.4	6.9	8.7	8.3	5.7	3.8	3.0	2.8	3.55	3.3
7	5.8	5.1	5.4	6.8	9.0	8.8	5.7	3.8	3.0	2.8	3.5	3.3
8	5.8	5.2	5.4	7.0	9.2	9.1	5.8	3.8	3.0	2.75	3.55	3.25
9	5.8	5.3	5.4	7.1	8.9	9.5	6.0	3.5	2.95	2.7	3.6	3.25
10	5.7	5.3	5.4	7.3	8.6	9.7	6.0	3.4	2.9	2.7	3.55	3.2
11	5.7	5.2	5.5	7.5	8.4	.....	5.8	3.4	2.9	2.7	3.5	3.2
12	5.6	5.2	5.9	7.9	8.3	.....	5.7	3.3	2.9	2.7	3.5	3.3
13	5.6	5.2	6.3	8.2	8.1	10.0	5.9	3.3	2.9	2.7	3.3	3.35
14	5.5	5.2	8.0	8.4	8.0	9.9	6.1	3.4	2.9	3.1	3.2	3.4
15	5.5	5.2	8.2	8.3	8.2	.....	5.8	3.4	2.9	3.2	3.25	3.35
16	5.4	5.3	.....	8.2	8.5	.....	5.7	3.4	2.95	3.15	3.2	3.3
17	5.5	5.4	.....	8.2	8.2	.....	5.6	3.3	2.9	3.1	3.2	3.3
18	5.6	5.4	.....	8.7	8.2	6.15	5.3	3.2	2.9	3.1	4.3	3.25
19	5.5	5.4	8.6	9.9	8.3	6.0	5.2	3.2	2.9	3.05	4.5	3.2
20	5.5	5.4	7.1	10.4	8.3	5.7	5.1	3.2	2.9	3.0	4.3	3.1
21	5.4	5.4	7.6	10.0	8.3	5.5	5.0	3.4	2.9	3.0	4.2	2.9
22	5.3	5.4	7.5	9.8	8.2	5.3	5.0	3.3	2.9	3.0	4.1	2.8
23	5.2	5.3	7.5	9.4	8.3	5.2	5.0	3.3	2.9	3.0	4.0	2.7
24	5.2	5.3	8.5	9.1	8.6	5.2	5.0	3.2	2.9	3.0	3.9	2.6
25	5.3	5.4	8.1	8.9	8.8	5.5	4.8	3.2	2.9	3.0	3.8	2.6
26	5.3	5.4	7.1	8.7	8.8	5.9	4.5	3.1	2.9	3.0	3.7	3.4
27	5.2	5.5	7.8	8.5	8.7	5.9	4.1	3.1	2.9	3.3	3.65	3.5
28	5.1	5.5	7.6	8.3	8.6	5.6	4.1	3.0	2.9	3.3	3.6	3.3
29	5.2	5.5	7.4	8.2	8.6	5.4	4.0	3.1	2.85	3.35	3.5	3.25
30	5.2	.....	7.3	8.3	8.5	5.6	3.9	3.1	2.8	3.4	3.45	3.2
31	5.3	.....	7.2	.....	8.4	.....	3.8	3.0	.....	3.75	.....	3.2

NOTE.—On March 30, 1907, a new chain gage was installed at the new toll bridge to replace the one destroyed by the flood of November, 1906. Datum the same as previous chain gage. This chain gage replaced a temporary staff gage installed November 22, 1906.

On December 10, 1907, the bridge was removed and with it the chain gage. A vertical staff gage was installed on the pile foundation of an old concrete pier on right bank about 50 feet upstream from end of old bridge. The gage was set at same datum as chain gage.

On June 18, 1908, a new vertical staff gage was installed about 800 feet above railroad bridge, and a few days later a new chain gage was installed reading the same as vertical gage.

Rating tables for Naches River near North Yakima, Wash.

NOVEMBER 15 TO DECEMBER 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.20	1,600	8.20	3,590	9.20	6,720	10.20	11,920
7.30	1,750	8.30	3.850	9.30	7,110	10.30	12,640
7.40	1,910	8.40	4,120	9.40	7,520	10.40	13.400
7.50	2,080	8.50	4,400	9.50	7,960	10.50	14,160
7.60	2,250	8.60	4,700	9.60	8,420	10.60	14,920
7.70	2,440	8.70	5,010	9.70	8,910	10.70	15,680
7.80	2,650	8.80	5,330	9.80	9,440	10.80	16,440
7.90	2,870	8.90	5,660	9.90	10,000	10.90	17,220
8.00	3,100	9.00	6.000	10.00	10,600	11.00	18,000
8.10	3,340	9.10	6,350	10.10	11,240		

JANUARY 1 TO DECEMBER 9, 1907.[b]

Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	90	4.60	350	5.90	760	7.40	2,540
3.40	105	4.70	375	6.00	810	7.60	2,970
3.50	120	4.80	400	6.10	870	7.80	3,430
3.60	140	4.90	425	6.20	940	8.00	3,940
3.70	160	5.00	450	6.30	1,010	8.20	4,510
3.80	180	5.10	475	6.40	1,090	8.40	5,110
3.90	200	5.20	500	6.50	1,180	8.60	5,730
4.00	220	5.30	530	6 60	1,280	8.80	6,370
4.10	240	5.40	565	6.70	1,400	9.00	7,050
4.20	260	5.50	600	6.80	1,530	9.20	7,750
4.30	280	5.60	640	6.90	1,670	9.40	8,450
4.40	300	5.70	680	7.00	1,820	9.60	9,150
4.50	325	5.80	720	7.20	2,150		

DECEMBER 10, 1907, TO JUNE 18, 1908.[c]

Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.70	1,400	7.40	2,350	8.20	3,860	9.60	7.300
6.80	1,520	7.50	2,520	8.40	4,280	9.80	7,900
6.90	1,640	7.60	2,700	8.60	4,730	10.00	8,500
7.00	1,770	7.70	2,890	8.80	5,200	10.20	9,120
7.10	1,900	7.80	3,080	9.00	5,690	10.40	9,770
7.20	2,040	7.90	3,270	9.20	6,200	10.60	10,450
7.30	2,190	8.00	3,460	9.40	6,730		

JUNE 19 TO DECEMBER 31, 1908.[d]

Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	120	3.60	650	4.60	1,910	5.60	3.610
2.70	148	3.70	750	4.70	2,070	5.70	3,790
2.80	178	3.80	860	4.80	2,230	5.80	3,970
2.90	210	3.90	970	4.90	2,390	5 90	4,150
3.00	248	4.00	1,080	5.00	2,560	6.00	4,330
3.10	294	4.10	1,200	5.10	2,730	6.20	4,710
3.20	348	4.20	1,330	5.20	2,900	6.40	5,090
3.30	410	4.30	1,470	5.30	3,070	6.60	5,470
3.40	480	4.40	1,610	5.40	3,250		
3.50	560	4.50	1,760	5.50	3,430		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during November, 1906, and the 1907 table, and is fairly well defined. It is used because the gage heights for this period refer to a datum 0.30 foot below the one used before and after.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1907 and is well defined. This table applies to gage heights from the chain gage established March 30, and to those from the temporary gage, which have been corrected to the same datum.

[c] This able is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908 and the 1907 low-water measurements and is fairly well defined. Below gage height 6.7 feet it is the same as the previous table. This table is for the staff gage, which was set to read the same as the chain gage at low stages, but as the fall between the gages became greater at high water a different table is necessary.

[d] This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1908 and is well defined above gage height 2.9 feet. It gives the discharge for gage heights on chain gage 800 feet upstream from railway bridge.

Monthly discharge of Naches River near North Yakima, Wash., for 1906 to 1908.

[Drainage area, 1,120 square miles.]

Month.	Discharge in second-feet.				Run-off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
1906.							
January	800	285	395	0.353	0.41	24,300	B.
February	2,190	525	1,030	.920	.96	57,200	B.
March	2,340	720	982	.877	1.01	60,400	B.
April	4,500	1,900	3,120	2.79	3.11	186,000	B.
May	4,890	1,470	3,040	2.71	3.12	187,000	B.
June	2,630	910	1,550	1.38	1.54	92,200	B.
July	1,210	185	646	.577	.67	39,700	C.
August	150	30	67.6	.060	.07	4,160	C.
September	185	30	74.8	.067	.07	4,450	C.
October	1,570	45	386	.345	.40	23,700	C.
November	21,900	525	4,290	3.83	4.27	255,000	C.
December	4,700	1,600	2,440	2.18	2.51	150,000	B.
The year	21,900	30	1,500	1.34	18.14	1,080,000	
1907.							
January [a]	.....	.....	950	.848	.98	58,400	C.
February [b]	.....	.....	2,520	2.25	2.34	140,000	B.
March	2,540	1,180	1,680	1.50	1.73	103,000	B
April	6,050	1,280	3,490	3.12	3.48	208,000	B.
May	8,620	3,680	6,100	5.45	6.28	375,000	B.
June	8,100	1,820	3,600	3.21	3.58	214,000	B.
July	1,820	375	830	.741	.85	51,000	B.
August	400	90	224	.200	.23	13,800	B.
September	280	105	184	.164	.18	10,900	B.
October	140	90	105	.094	.11	6,460	B.
November	940	120	231	.206	.23	13,700	B.
December	2,190	425	840	.750	.86	51,600	B.
The year	8,620	90	1,730	1.54	20.85	1,250,000	
1908.							
January	810	475	620	.554	.64	38,100	B.
February	600	450	527	.471	.51	30,300	B.
March	4,730	565	2,100	1.88	2.17	129,000	B.
April	9,770	1,520	4,090	3.65	4.07	243,000	B.
May	6,200	3,460	4,570	4.08	4.70	281,000	B.
June	8,500	2,900	4,970	4.44	4.95	296,000	B.
July	5,280	860	3,230	2.88	3.32	199,000	A.
August	860	248	492	.439	.51	30,300	A.
September	248	178	219	.196	.22	13,000	A.
October	805	148	268	.239	.28	16,500	B.
November	1,760	348	762	.680	.76	45,300	A.
December	560	120	366	.327	.38	22,500	B.
The year	9,770	120	1,850	1.65	22.51	1,340,000	

[a] Discharge estimated from other stations in vicinity.
[b] Discharge for February 1 to 10 taken as sum of Naches River near Nile and Tieton River near Naches.

NOTE.—Discharge 1906–1908 does not include water diverted above the gaging station by the North Yakima power canal, which amounts to from 80 to 200 second-feet.

TIETON RIVER AT M'ALLISTER MEADOWS, NEAR NACHES, WASH.

This station was established August 28, 1908. It is located 9 miles above the headworks of the Tieton canal and 800 feet above McAllister Meadows dam site. It is about 1½ miles below the mouth of South Fork of the Tieton and one-half mile above the mouth of Wildcat Creek.

The data obtained here are useful chiefly to the Reclamation Service, as it is expected that the McAllister Meadows will be utilized as a reservoir. The principal value of the records will be to

determine the relation between the flow at this point and that obtained at the headworks of the Tieton canal and at the mouth of Tieton River, where records of several years standing are available.

Discharge measurements of Tieton River at McAllister Meadows, near Naches, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 28[a]	C. F. Gleason	.....	133	1.63	315
September 30	do	.....	136	1.50	278
November 11	L. R. Allen	91	118	1.30	205

[a] Measured by wading.

Daily gage heights of Tieton River at McAllister Meadows, near Naches, Wash., 1908.

[H. O. Treadwell, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	1.53	1.65	1.58	17	.....	1.46	1.33	1.90
2	.....	1.58	1.45	1.79	18	.....	1.48	1.32	2.65
3	.....	1.65	1.34	1.77	19	.....	1.45	1.34	2.20
4	.....	1.63	1.31	1.60	20	.....	1.49	1.31	2.24
5	.....	1.66	1.30	1.49	21	.....	1.47	1.28	2.03
6	.....	1.67	1.30	1.44	22	.....	1.50	1.26	1.89
7	.....	1.70	1.31	1.40	23	.....	1.44	1.27	1.78
8	.....	1.63	1.32	1.39	24	.....	1.40	1.27	1.72
9	.....	1.51	1.36	1.37	25	.....	1.37	1.26	.....
10	.....	1.63	1.37	1.33	26	.....	1.30	1.27	.....
11	.....	1.65	1.34	1.29	27	.....	1.30	1.28	.....
12	.....	1.67	1.35	1.28	28	1.75	1.30	1.33	.....
13	.....	1.65	1.50	1.31	29	1.65	1.39	1.49	.....
14	.....	1.68	1.70	1.29	30	1.56	1.52	1.76	.....
15	.....	1.67	1.46	1.29	31	1.54	.....	1.85	.....
16	.....	1.54	1.39	1.50					

Rating table for Tieton River at McAllister Meadows, near Naches, Wash., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	188	1.80	417	2.30	750
1.30	205	1.90	475	2.40	825
1.40	232	2.00	535	2.50	900
1.50	267	2.10	600	2.60	980
1.60	312	2.20	675	2.70	1,060
1.70	362				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908 and is well defined below gage height 1.6 feet. Above gage height 2.0 feet it is approximate.

Monthly discharge of Tieton River at McAllister Meadows, Wash., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
September	362	205	287	17,100	B.
October	446	198	239	14,700	B.
November 1–24	1,020	202	367	17,500	B.

TIETON RIVER AT HEADWORKS OF TIETON CANAL NEAR NACHES, WASH.

This station, which was established March 29, 1906, was moved on June 27, 1907, to a point about one-half mile above its former position. It is now located about 500 feet below the intake of the Tieton canal, which has recently been constructed by the United States Reclamation Service, and 15 miles above the mouth of the stream. There are no tributaries in the immediate vicinity of the station. Two gages have been used—the one at the cable, where measurements were made; the other at Weisberger's power plant, 1½ miles downstream. The measurements are referred to both gages, and a rating curve has been developed for each.

The records obtained at this station furnish data of great value in connection with the general reclamation of the Yakima Valley. The entire flow of Tieton River at low water will be diverted to irrigate lands in the vicinity of North Yakima. The amount so taken will be replaced from the Bumping Lake storage reservoir on the headwaters of Naches River.

As the velocity of the water is rapid, ice does not interfere with the determination of flow during the winter season. Great difficulty has been encountered in obtaining continuous gage observation, as this portion of the country is uninhabited. The conditions at the station are not ideal, but it is believed that the results are as reliable as can be procured under the natural conditions of channel which exist on this stream.

Discharge measurements of Tieton River at headworks near Naches, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height. At power house.	Gage height. At cable.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
June 27	Stevens and McGlashan	100	295	5.35	4.10	1,100
August 20	H. D. McGlashan	90	154	3.57	2.70	330
September 16	H. J. Doolittle				2.65	317
September 17	do				2.55	290
September 25	do	87	138		2.45	269
September 27	J. C. Stevens	88	141		2.51	271
October 24	H. D. McGlashan	87	133	3.33	2.40	238
1908.						
April 21	H. D. McGlashan	103	356	6.25	4.65	1,780
July 15	Allen and Gleason	97	309	5.65	4.30	1,280
August 26	C. F. Gleason	88	167	3.70	2.72	352
September 17 [a]	L. R. Allen	87	147	3.52	2.61	290
November 12 [a]	Allen and Gleason	85	131	3.35	2.42	235

[a] Measurement made with defective meter and not used in making rating.

Daily gage height, in feet, of Tieton River at headworks, near Naches, Wash., for 1907.

[R. James Zell, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.20	2.56	2.40	3.14	3.75	17	3.35	2.60	2.50	2.38	2.99	3.20
2	.....	3.25	2.80	2.30	3.21	3.64	18	3.35	2.60	2.50	2.40	2.98	3.19
3	.....	3.25	2.66	2.30	3.10	3.58	19	3.20	2.60	2.50	2.38	3.01	3.14
4	.....	3.15	2.70	2.40	3.07	3.51	20	3.30	2.60	2.40	2.38	3.04	3.22
5	3.70	3.00	2.76	2.45	3.18	3.53	21	3.35	2.70	2.50	2.42	3.04	3.24
6	.....	2.90	2.76	2.50	3.18	3.46	22	3.25	2.70	2.50	2.40	3.08	3.70
7	.....	2.95	2.70	2.47	3.09	3.45	23	3.25	2.80	2.40	2.40	3.14	4.15
8	3.55	3.00	2.76	2.54	3.10	3.36	24	3.15	2.80	2.50	2.38	3.40	5.00
9	3.60	2.80	2.70	2.46	3.00	3.39	25	3.10	2.90	2.50	2.35	3.58	4.45
10	3.60	2.90	2.80	2.45	3.01	3.36	26	3.10	2.60	2.50	2.38	3.95	4.26
11	3.55	2.70	2.80	2.48	3.26	3.34	27	3.15	2.60	2.40	3.32	3.55	4.05
12	3.55	2.70	2.60	2.42	3.01	3.34	28	3.15	2.60	2.40	3.37	3.38	3.90
13	3.45	2.60	2.50	2.45	3.00	3.32	29	3.15	2.60	2.30	3.46	4.35	3.78
14	3.40	2.60	2.50	2.40	3.04	3.26	30	3.20	2.60	2.40	3.43	4.32	3.74
15	3.25	2.60	2.40	2.42	3.01	3.24	31	3.25	2.50	.....	3.21	.....	3.69
16	3.25	2.60	2.50	2.40	3.00	3.12							

NOTE.—Gage heights from July 5 to October 26 are at the gage at the cable; from October 27 to December 31 they are at Wiesberger's power plant.

Daily gage heights of Tieton River at headworks, near Naches, Wash., for 1908.

AT CABLE.

[J. C. Lawrence, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.66	2.84	2.84	2.53	17	.....	2.62	2.48	2.82	.....
2	.....	2.71	2.60	2.92	2.50	18	.....	2.62	2.45	4.06	.....
3	.....	2.78	2.48	3.03	2.47	19	.....	2.60	2.48	3.34	.....
4	.....	2.76	2.42	2.85	2.42	20	.....	2.62	2.46	3.46	.....
5	.....	2.81	2.43	2.68	2.40	21	.....	2.64	2.42	3.22	.....
6	.....	2.81	2.42	2.60	2.40	22	.....	2.62	2.40	3.05	.....
7	.....	2.85	2.42	2.54	2.40	23	.....	2.54	2.40	2.94	.....
8	.....	2.76	2.45	2.51	2.42	24	.....	2.47	2.40	2.82	.....
9	.....	2.64	2.50	2.50	2.41	25	.....	2.44	2.40	2.72	.....
10	.....	2.76	2.51	2.47	2.38	26	2.74	2.42	2.39	2.62	.....
11	.....	2.80	2.47	2.44	2.37	27	2.70	2.40	2.39	2.64	.....
12	.....	2.82	2.48	2.42	2.48	28	2.80	2.42	2.40	2.60	.....
13	.....	2.80	2.65	2.40	.....	29	2.80	2.41	2.48	2.58	.....
14	.....	2.83	2.88	2.38	.....	30	2.69	2.62	2.88	2.60	.....
15	.....	2.80	2.72	2.36	.....	31	2.66	.....	3.12	.....	.....
16	.....	2.66	2.54	2.41	.....						

AT POWER HOUSE.

[J. M. Cook, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.62	3.05	3.42	4.20	5.30	5.08	6.35	.....	3.58	3.68	3.74	.....
2	3.62	3.26	3.40	4.15	5.42	5.05	6.35	.....	3.75	3.50	3.85	.....
3	3.56	3.29	3.34	4.25	5.28	5.08	6.38	.....	3.71	3.36	3.96	.....
4	3.48	3.31	3.32	4.28	5.22	5.12	6.20	.....	3.66	3.34	3.75	.....
5	3.47	3.42	3.30	4.15	5.48	5.22	5.80	.....	3.76	3.34	3.60	.....
6	3.47	3.49	3.21	4.12	5.70	5.55	5.55	.....	3.75	3.34	3.49	.....
7	3.45	3.42	3.24	4.10	5.65	5.80	5.75	.....	3.75	3.35	3.44	.....
8	3.46	3.33	3.28	4.12	5.62	6.25	5.90	.....	3.68	3.39	3.40	.....
9	3.46	3.23	3.29	4.18	5.52	6.65	6.05	.....	3.55	3.42	3.41	.....
10	3.44	3.20	3.30	4.28	5.25	6.75	6.00	.....	3.64	3.45	3.35	.....
11	3.41	3.21	3.44	4.45	5.12	6.92	5.85	3.98	3.72	3.40	3.32	.....
12	3.32	3.18	3.66	4.75	5.08	6.80	5.90	3.98	3.72	3.37	3.31	.....
13	3.39	3.18	4.80	5.00	4.98	6.58	6.30	4.00	3.69	3.56	3.26	3.50
14	3.37	3.21	5.45	5.00	4.88	6.55	5.95	4.20	3.72	3.78	3.24	3.20
15	3.29	3.22	6.70	4.95	5.10	6.90	.....	4.12	3.71	3.65	3.22	3.30

Daily gage heights of Tieton River at headworks, near Naches, Wash., for 1908—Continued.

AT POWER HOUSE—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.34	3.29	7.25	4.95	4.98	6.60	.....	4.14	3.58	3.47	3.29	3.25
17	3.34	3.32	6.30	5.05	4.90	6.15	.....	4.10	3.52	3.42	3.66	3.20
18	3.36	3.29	5.58	5.90	5.00	5.85	.....	4.12	3.54	3.38	5.38	3.12
19	3.36	3.30	5.35	6.40	5.02	5.62	.....	4.06	3.52	3.41	4.42	3.10
20	3.33	3.24	5.00	6.80	4.98	5.40	.....	4.32	3.52	3.40	4.54	3.00
21	3.23	3.22	4.78	6.75	4.98	5.15	.....	4.14	3.55	3.36	4.30	3.00
22	3.16	3.26	4.78	5.80	4.98	5.00	.....	4.08	3.54	3.34	.....	3.00
23	3.26	3.29	4.85	5.62	5.12	5.05	.....	4.08	3.43	3.32	.....	3.05
24	3.26	3.31	5.10	5.68	5.40	5.25	.....	3.94	3.38	3.31	.....	3.10
25	3.26	3.30	4.95	5.38	5.48	5.70	.....	3.80	3.34	3.29	.....	3.20
26	3.20	3.37	4.75	5.25	5.40	5.90	.....	3.69	3.32	3.34	.....	3.40
27	3.11	3.42	4.58	5.15	5.32	5.52	.....	3.72	3.28	3.32	.....	3.40
28	3.22	3.42	4.42	5.15	5.38	5.28	.....	3.78	3.30	3.33	.....	3.40
29	3.34	3.44	4.38	4.95	5.30	5.32	.....	3.71	3.35	3.41	.....	3.40
30	3.22	.....	4.30	5.08	5.18	5.68	.....	3.64	3.53	3.76	.....	3.35
31	3.01	.....	4.25	.....	5.12	.....	.....	3.61	.....	4.10	.....	3.30

NOTE.—During 1908 the channel was not frozen over; January 8–Feb. 10 there was shore ice from 1 to 10 inches thick.

Rating tables for Tieton River at headworks near Naches, Wash., for 1907 and 1908.

AT CABLE.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	210	3.20	538	4.10	1,100
2.40	238	3.30	586	4.20	1,190
2.50	268	3.40	636	4.30	1,290
2.60	300	3.50	690	4.40	1,400
2.70	334	3.60	745	4.50	1,540
2.80	370	3.70	805	4.60	1,700
2.90	408	3.80	870	4.70	1,880
3.00	448	3.90	940		
3.10	492	4.00	1,020		

AT POWER HOUSE.[b]

Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft*
2.90	128	4.20	550	5.50	1,190
3.00	150	4.30	590	5.60	1,250
3.10	175	4.40	630	5.70	1,310
3.20	200	4.50	670	5.80	1,380
3.30	230	4.60	715	5.90	1,455
3.40	260	4.70	760	6.00	1,540
3.50	295	4.80	805	6.20	1,730
3.60	330	4.90	855	6.40	1,945
3.70	365	5.00	910	6.60	2,190
3.80	400	5.10	965	6.80	2,460
3.90	435	5.20	1,020	7.00	2,770
4.00	470	5.30	1,075	7.20	3,090
4.10	510	5.40	1,130	7.40	3,410

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 10 discharge measurements made during 1907–8 and is well defined between gage heights 2.4 feet and 4.7 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1907–8 and is well defined between gage heights 3.3 feet and 6.3 feet.

Monthly discharge of Tieton River at headworks near Naches, Wash., for 1907 and 1908 (at power house).

[Drainage area, 247 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
July	955	492	652	2.64	3.04	40,100	A.
August	562	268	366	1.48	1.71	22,500	A.
September	370	210	289	1.17	1.30	17,200	A.
October	281	203	243	.984	1.13	14,900	A.
November	610	146	223	.903	1.01	13,300	B.
December	910	180	334	1.35	1.56	20,500	A.
The period						128,000	
1908.[a]							
January	634	152	259	1.05	1.21	15,900	A.
February	292	162	228	.923	1.00	13,100	A.
March	3,170	203	764	3.09	3.56	47,000	A.
April	2,460	510	965	3.91	4.36	57,400	A.
May	1,310	845	1,040	4.21	4.85	64,000	A.
June	2,640	910	1,500	6.07	6.77	89,300	A.
July	1,920	600	1,250	5.06	5.83	76,900	B.
August	680	334	496	2.01	2.32	30,500	A.
September	386	224	320	1.30	1.45	19,000	A.
October	510	227	279	1.13	1.30	17,200	A.
November	1,120	206	372	1.51	1.68	22,,00	A.
December	295	150	224	.907	1.05	13,800	B.
The year	3,170	150	641	2.60	35.38	466,000	

[a] Discharges for 1908 are based on the records at Weisberger's power house, except November 22 to December 12, when they are based on gage readings at the cable, and from July 15 to August 10, when they have been interpolated by the aid of a hydrograph, based on the rise and fall of the river at Camp No. 1 of the United States Reclamation Service.

Monthly discharge of Tieton River at headworks near Naches, Wash., for 1908. (Cable gage.)

[Drainage area, 247 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
September	389	238	321	1.30	1.45	19,100	A.
October	501	235	280	1.13	1.30	17,200	A.
November	1,070	227	373	1.51	1.68	22,200	A.

NOTE.—These discharges are based on gage readings at the cable, and are included for comparative purposes.

TIETON RIVER NEAR NACHES, WASH.

This station has been located at various points since it was first established on April 24, 1902. From April 24, 1902, to March 7, 1906, it was located just below the mouth of Oak Creek. On the latter date it was removed to a point 200 feet above the mouth of Oak Creek, thus excluding 19 square miles of drainage area. On March 23, 1907, the station was again moved to the highway bridge at Camp

No. 1 of the United States Reclamation Service, where construction of the Tieton Canal tunnels was under way. At this point a power plant was built for the generation of electric power to be used in the excavation of the tunnels. As the bridge from which the measurements were made and the gage are both located between the intake of the canal and the power house, the flow of the canal should be added to that obtained in the river in order to represent the natural flow of the stream. It was impracticable to rate the power canal, and on this account no estimates of the flow at this point have been made since the power canal was put in operation, July 10, 1907.

Discharge measurements of Tieton River near Naches, Wash., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				Old gage.	New gage.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
February 2[a]	W. C. Muldrow	65	215	4.80	.....	461
March 6	do	70	226	5.35	4.15	562
March 23	H. D. McGlashan	73	202	4.90	3.85	403
May 6	do	78	307	6.90	5.25	1,380
June 24	Stevens and McGlashan	77	282	.....	4.77	913
August 19	H. D. McGlashan	71	181	.....	3.39	249
September 21	R. F. Melin	70	149	.....	2.92	136
October 24	H. D. McGlashan	68	129	.....	2.70	89

[a] Measurement unreliable because of ice in channel.

Daily gage height, in feet, of Tieton River near Naches, Wash, for 1907.

[R. F. Melin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.40	4.90	5.70	4.00	4.80	5.78	4.65	4.00	3.19	2.80	2.65	3.45
2	5.32	4.75	5.62	3.90	4.85	5.58	4.72	4.00	3.45	2.80	2.65	3.25
3	5.40	4.70	5.70	3.85	4.95	5.45	4.82	4.00	3.30	2.80	2.65	3.14
4	5.38	4.70	5.60	3.98	5.00	5.40	4.65	4.00	3.30	2.80	2.60	3.05
5	5.20	4.65	5.48	3.95	5.15	5.50	4.50	3.90	3.35	2.90	2.60	3.08
6	5.10	5.60	5.40	3.98	5.25	5.85	4.50	3.70	3.35	3.00	2.60	2.92
7	5.02	6.18	5.60	4.05	5.35	5.22	4.40	3.65	3.28	2.80	2.55	2.90
8	5.00	6.48	5.45	4.50	5.50	5.12	4.40	3.85	3.26	2.80	2.55	2.90
9	4.90	6.72	5.30	4.82	5.40	5.10	4.45	[a] 3.83	3.34	2.70	2.50	2.80
10	4.82	6.45	5.30	4.68	5.35	5.00	4.50	3.55	3.36	2.70	[a] 3.15	2.80
11	4.95	6.25	5.30	4.62	5.30	5.12	4.55	3.43	3.42	2.70	2.50	2.75
12	4.95	6.08	5.30	4.68	5.30	5.08	4.42	3.48	3.21	2.70	2.50	2.80
13	4.82	5.98	5.30	4.95	5.10	4.92	4.32	3.48	3.10	2.70	2.50	2.70
14	4.72	5.90	5.20	4.98	5.12	4.78	4.25	3.50	3.00	2.70	2.50	2.70
15	4.65	5.78	5.20	4.95	5.40	4.68	4.25	3.50	3.01	2.70	2.50	2.62
16	4.78	5.70	5.20	4.98	5.72	4.65	4.22	3.50	3.42	2.80	2.50	2.55
17	4.70	5.70	5.18	4.88	5.72	4.60	4.15	3.55	3.20	2.75	2.50	2.55
18	4.82	5.62	5.15	4.78	5.75	4.70	4.10	3.46	3.05	2.85	2.50	2.60
19	4.80	5.70	5.10	4.75	5.72	4.92	.....	3.42	3.00	2.75	2.50	2.60
20	4.85	5.98	5.05	4.70	5.60	5.00	4.05	3.45	2.95	2.70	2.50	2.60
21	5.08	6.05	5.00	4.70	5.38	4.98	4.20	3.45	2.95	2.70	2.50	2.60
22	5.00	6.00	5.00	4.97	5.28	4.88	4.20	3.60	2.95	2.70	2.50	3.20
23	4.88	5.95	3.82	5.05	5.22	4.70	4.02	3.60	2.90	2.70	2.55	3.72
24	4.80	5.92	3.76	5.00	5.20	4.78	4.00	3.65	2.93	2.70	2.65	4.45
25	4.75	6.10	3.80	5.00	5.20	4.80	3.90	3.60	2.90	2.70	3.22	4.05
26	4.70	5.95	3.79	4.95	.....	4.92	3.90	3.60	2.95	[a] 3.30	3.70	3.88
27	4.68	5.80	3.78	4.85	5.25	5.28	3.95	3.30	2.98	2.70	3.30	3.70
28	4.75	5.78	3.75	4.72	5.38	5.05	3.95	3.20	.....	2.75	3.00	3.60
29	4.70	.....	3.74	4.80	5.50	4.98	3.98	3.20	2.75	2.73	3.98	3.45
30	4.70	.....	3.72	4.80	5.55	.....	3.95	3.20	2.75	2.83	3.85	3.30
31	4.90	.....	3.78	.....	5.72	.....	4.00	3.12	.....	2.68	.....	3.20

[a] Water turned out of canal at time gage was read. Water was diverted past the gage in power canal at other times after about July 10, 1907.

Daily gage height, in feet, of Tieton River near Naches, Wash., for 1908.[a]

[P. C. Nolin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	3.30	2.60	3.80	4.70	4.55	5.35	4.10	2.90	3.00	3.15	3.00
2	3.20	3.50	2.55	3.75	4.70	4.55	5.35	4.10	3.00	2.95	3.05	2.90
3	3.10	2.80	2.55	3.80	4.75	4.55	5.40	3.90	3.05	2.75	3.30	2.90
4	3.10	2.70	2.55	3.80	4.65	4.60	5.20	3.90	3.10	2.70	3.20	2.85
5	3.05	2.90	2.55	3.75	4.70	4.60	5.00	3.90	3.10	2.70	2.90	2.90
6	3.05	2.70	2.50	3.70	4.80	4.85	4.95	3.90	3.10	2.70	2.80	2.60
7	3.00	2.70	2.50	3.65	5.00	5.05	5.00	3.85	3.15	2.70	2.70	2.65
8	3.00	2.60	2.50	3.65	4.95	5.28	5.10	3.80	3.00	2.70	2.70	2.70
9	3.00	2.50	2.50	3.80	4.80	5.50	5.10	3.80	2.90	2.70	2.60	2.60
10	2.95	2.45	2.50	3.85	4.70	5.65	5.15	3.80	3.00	2.70	2.60	2.60
11	2.95	2.45	2.60	4.00	4.60	5.72	5.10	3.75	3.15	.....	2.60	2.60
12	2.90	2.40	3.05	4.25	4.60	5.65	5.10	3.65	3.20	.....	2.50	2.65
13	2.90	2.40	4.18	4.35	4.52	5.50	5.38	3.60	3.20	.....	2.50	2.70
14	2.85	2.40	4.95	4.40	4.45	5.50	5.12	3.80	3.20	3.05	2.50	2.60
15	2.80	2.45	5.60	4.40	4.55	5.72	4.95	3.70	3.20	3.10	2.50	2.50
16	2.80	2.50	6.00	4.40	4.48	5.55	4.90	3.70	3.00	2.80	2.50	2.60
17	2.75	2.50	5.45	4.40	4.40	5.32	4.80	3.70	3.00	2.70	2.85	2.50
18	2.80	2.45	5.12	5.00	4.55	5.12	4.70	3.70	2.90	2.70	4.50	3.00
19	3.30	2.45	4.70	5.50	4.55	4.98	4.70	3.70	2.80	2.70	4.10	3.15
20	2.60	2.40	4.50	5.55	4.55	4.80	4.70	3.90	2.85	2.70	4.10	3.20
21	2.60	2.45	4.35	5.30	4.55	4.65	4.80	3.80	2.85	2.65	3.85	2.35
22	2.65	2.45	4.25	5.02	4.50	4.55	4.75	3.75	2.90	2.60	3.70	2.35
23	2.70	2.45	4.50	5.00	4.60	4.60	4.75	3.70	2.80	2.60	3.55	2.50
24	2.60	2.50	4.35	5.00	4.75	4.70	4.75	3.70	2.80	2.60	3.40	2.50
25	2.60	2.60	4.25	4.80	4.90	5.10	4.60	3.55	2.70	2.60	3.30	2.60
26	2.60	2.70	4.25	4.60	4.80	5.20	4.35	3.15	2.70	2.60	3.10	3.00
27	2.60	2.70	4.10	4.60	4.75	4.90	4.20	3.10	2.70	2.60	3.10	2.95
28	2.60	2.70	4.00	4.50	4.75	4.70	4.10	3.10	2.70	2.60	3.10	3.30
29	2.60	2.60	4.00	4.50	4.75	4.75	4.00	3.20	2.70	2.65	3.00	2.70
30	2.60	.....	3.90	4.50	4.70	5.00	3.95	3.00	2.80	2.90	3.00	2.60
31	3.30	.....	3.85	.....	4.55	.....	3.95	3.00	.....	3.65	.....	2.60

[a] River from one-fourth to one-half frozen over January 22 to February 23, the ice reaching a thickness of 8 inches along the edges. The power canal diverted water past the gage during the entire year, except January 19, January 31 to February 3, December 18 to 20, and December 28.

Rating tables for Tieton River near Naches, Wash.

JANUARY 1 TO MARCH 22, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.60	300	5.40	596	6.20	995
4.70	330	5.50	640	6.30	1,050
4.80	362	5.60	685	6.40	1,105
4.90	396	5.70	735	6.50	1,160
5.00	432	5.80	785	6.60	1,215
5.10	470	5.90	835	6.70	1,270
5.20	510	6.00	885	6.80	1,330
5.30	552	6.10	940		

MARCH 23 TO DECEMBER 31, 1907.[b]

2.50	64	3.70	350	4.90	1,065
2.60	77	3.80	390	5.00	1,150
2.70	92	3.90	430	5.10	1,240
2.80	109	4.00	480	5.20	1,330
2.90	127	4.10	530	5.30	1,425
3.00	148	4.20	585	5.40	1,525
3.10	171	4.30	640	5.50	1,635
3.20	196	4.40	700	5.60	1,750
3.30	222	4.50	770	5.70	1,870
3.40	250	4.60	840	5.80	1,990
3.50	282	4.70	915	5.90	2,120
3.60	315	4.80	990		

[a] This table is not applicable for ice or obstructed channel conditions. It is based on 3 discharge measurements made during 1907 and is well defined above gage height 4.9 feet.

[b] This table is not applicable for ice or obstructed channel conditions. It is based on 6 discharge measurements made during 1907 and is well defined between gage heights 2.7 feet and 5.3 feet.

Monthly discharge of Tieton River near Naches, Wash., for 1907.

[Drainage area, 270 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	596	315	408	1.51	1.74	25,100	B.
February	1,280	315	786	2.91	3.03	43,700	B.
March	735	358	511	1.89	2.18	31,400	A.
April	1,200	410	887	3.29	3.67	52,800	A.
May	1,930	990	1,470	5.44	6.27	90,400	A.
June	2,060	840	1,220	4.52	5.04	72,600	A.
The period						316,000	

Discharge measurements of U. S. Reclamation Service power canal near Naches, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage. height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 19	Ray Melin	6.6	15		88
October 25	do	24	76		130
November 2	do	24	72		122
November 11	do	24	72		100
November 13	do	24	72		103
November 25	do	26	88		170
1908.					
March 13	Ray Melin	25	84		193
September 18	do	24	72	4.37	167

Daily gage geight, in feet, of U. S. Reclamation Service power canal near Naches, Wash., for 1908.

[P. C. Nolin, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		4.6	4.6	4.05	16		4.3	4.2	4.2
2		4.6	4.6	4.05	17		4.2	4.6	5.3
3		4.4	4.7	4.0	18		4.2	4.8	
4		4.2	4.6	4.0	19		4.2	4.3	
5		4.2	4.5	4.3	20	4.5	4.2	4.35	
6		4.2	4.3	4.85	21	4.5	3.95	4.3	4.2
7		4.2	4.45	4.4	22	4.45	3.9	4.25	4.15
8		4.2	4.45	4.25	23	4.3	3.9	4.25	4.45
9		4.2	4.4	4.25	24	4.3	3.9	4.2	4.35
10		4.2	4.4	4.2	25	4.25	4.0	4.15	4.4
					26	4.25	4.05	4.1	4.45
11			4.3	4.1	27	4.25	4.05	4.1	3.4
12			4.3	4.2	28	4.25	4.1	4.05	
13			4.25	4.3	29	4.2	4.15	4.1	3.9
14		4.5	4.25	4.2	30	4.5	4.5	4.1	3.6
15		4.5	4.25	4.6	31		4.7		3.7

NOTE.—The water was shut off December 18 to 20, inclusive, and December 28; no record October 11, to 13, water probably running.

NORTH FORK OF ATANUM CREEK NEAR TAMPICO, WASH.

Atanum Creek, which is formed by the union of North and South Forks, near Tampico, in Yakima County, flows eastward, joining Yakima River about 10 miles below the mouth of Naches River. The creek and its south fork make the greater part of the northern boundary of the Yakima Indian Reservation.

A gaging station was established August 26, 1907, on the North Fork at Goodman's ranch, 3½ miles above the junction with South Fork, and 100 feet below the mouth of Nasty Creek. It is above all diversions from the stream.

The data obtained here have considerable value as the waters of this stream are extensively used for irrigation throughout the Atanum Valley by both Indian and white settlers.

The conditions at the station are not favorable for very accurate results. The station was installed primarily to determine the low-water flow. The current is swift and there are no facilities for making measurements except by wading. An estimate of the flow at higher stages has been made by extending the discharge curve. The records at the station are not complete, as it was impossible to obtain continuous observation of gage height.

Discharge measurements of North Fork of Atanum Creek near Tampico, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 15	W. C. Muldrow	30	35	(a)	37
August 26	H. D. McGlashan	27	27	1.40	27
1908.					
May 1	H. D. McGlashan	28	27	2.25	b 132
June 26	J. C. Stevens	39	62	2.30	195
September 14	L. R. Allen	22	22.4	1.30	19.6
November 2	do	23	24	1.36	26

a Water surface 2.52 feet below bent staple in upstream face of dead cottonwood, right bank, 300 yards above Goodman's ranch.

b Measurement discarded as it was made at angle of 60° to current where conditions were very poor.

Daily gage height, in feet, of North Fork of Atanum Creek near Tampico, Wash., for 1907 and 1908.

[A. A. Nicol, observer.]

Day.	1907.			1908.							
	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			1.35			2.3	2.3		1.4		
2			1.3		2.2	2.3	2.4	1.6			1.4
3			1.3		2.3	2.4		1.6	1.4		1.4
4			1.5		2.3	2.5		1.5	1.4		1.4
5			1.5		2.3	2.5		1.5	1.4		1.4
6			1.45	1.8	2.4	2.5	2.2	1.5	1.4		1.4
7				1.8	2.5	2.6	2.1	1.5			1.3
8	1.4			1.8	2.4	2.9	2.1	1.5	1.4		1.3
9		1.3		1.9	2.4	2.8	2.1	1.5	1.4		1.3
10		1.35		1.9	2.3	2.8	2.1	1.5	1.4		1.3

Daily gage height, in feet, of North Fork of Atanum Creek near Tampico, Wash., for 1907 and 1908—Continued.

Day.	1907.			1908.							
	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	1.4	.....	2.1	2.3	2.9	2.1	1.5	1.4	.....	1.3
12	.....	1.4	.....	2.2	2.3	2.8	2.1	.....	1.3	1.4	1.3
13	.....	1.3	.....	2.3	2.3	2.7	2.1	1.5	1.3	1.4	1.3
14	.....	1.4	.....	2.3	2.2	2.8	2.0	1.5	1.3	1.5	1.3
15	.....	1.35	.....	2.2	2.4	2.8	2.0	1.5	1.3	1.5	1.4
16	.....	1.3	.....	2.1	2.4	2.8	2.0	1.5	1.3	1.5	1.4
17	.....	1.4	.....	2.2	2.2	2.6	1.9	1.5	1.3	1.4	1.4
18	.....	1.4	.....	2.4	2.2	2.5	1.8	1.5	1.3	1.4	1.5
19	.....	1.35	.....	2.5	2.2	2.4	1.8	.....	1.3	1.4	1.5
20	.....	1.4	.....	2.8	2.2	2.3	1.8	.....	1.3	1.4	1.5
21	1.4	1.4	.....	2.6	2.3	2.3	1.8	1.4	1.3	1.3	1.5
22	.....	1.5	.....	2.4	2.3	2.2	1.8	1.4	1.3	1.3	1.5
23	.....	1.4	.....	4.4	2.3	2.2	1.7	1.4	1.3	1.3	1.4
24	.....	1.35	.....	2.3	2.3	2.3	1.7	1.4	1.3	1.3	1.4
25	.....	1.3	.....	2.2	2.4	2.2	1.7	1.4	1.3	.....	.....
26	.....	1.3	.....	2.2	2.4	2.3	1.7	1.4	1.3	.....	.....
27	.....	1.5	.....	2.2	2.4	2.3	1.7	1.4	1.3	.....	.....
28	.....	1.45	.....	2.1	2.4	2.2	1.7	1.4	1.3	.....	.....
29	.....	1.4	.....	2.1	2.5	2.2	1.6	1.4	.....	.....	.....
30	.....	1.4	.....	.....	.....	2.2	1.6	1.4	.....	.....	.....
31	.....	1.4	.....	.....	2.4	.....	1.6	1.4	.....	.....	.....

Rating table for North Fork of Atanum Creek near Tampico, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	20	1.80	73	2.30	197	2.80	368
1.40	27	1.90	91	2.40	229	2.90	407
1.50	36	2.00	112	2.50	262	3.00	448
1.60	46	2.10	137	2.60	296		
1.70	58	2.20	166	2.70	331		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907–8 and is well defined below gage height 1.5 feet.

Monthly discharge of North Fork of Atanum Creek near Tampico, Wash., for 1907 and 1908.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
September [a]	27	27	27.0	0.409	0.46	1,610	B.
October	36	20	25.5	.386	.44	1,570	A.
November 1–6	36	20	28.0	.424	.09	333	A.
The period	.....	.....	.....	.....	.....	3,510	
1908.							
April 6–30	368	73	172	2.61	2.43	8,530	B.
May	262	156	206	3.12	3.60	12,700	B.
June	407	166	261	3.95	4.41	15,500	B.
July	229	46	110	1.67	1.92	6,760	B.
August	46	27	33.5	.508	.59	2,060	A.
September	27	20	22.6	.342	.38	1,340	A.
October	36	20	24.7	.374	.43	1,520	A.
November 1–24	36	20	26.5	.402	.36	1,260	A.
The period	.....	.....	.....	.....	.....	49,700	

[a] Discharge assumed constant during September.

ATANUM CREEK AT NARROWS, NEAR TAMPICO, WASH.

This station was established June 25, 1908. It is located at a point in the river locally known as "The Narrows," 3½ miles east of Tampico and 3 miles below the junction of North and South forks.

The flow here presumably includes all return waters from irrigation in the upper part of the drainage basin; but this presumption is very doubtful as the situation is greatly complicated by an innumerable number of small ditches both above and below the station, and the records should not be considered to represent the natural run-off from this drainage area.

Discharge measurements of Atanum Creek at Narrows, near Tampico, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
August 16		25	22	.....	21
1908.					
June 25	J. C. Stevens	28	63	1.88	200
September 14 [a]	L. R. Allen	28	35	0.89	24
November 2	do	25	32	0.98	33

[a] Measured by wading.

Daily gage height, in feet, of Atanum Creek at Narrows, near Tampico, Wash., for 1908.

[F. H. Alm, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.81	0.98	0.90	.....	1.00	1.00	16	.....	.....	0.92	.....	0.90	0.95	0.97
2	.....	1.80	.98	.90	0.89	.98	.98	17	.....	1.45	.90	.....	.90	.95	.85
3	.....	1.82	.97	.90	.88	.98	1.00	18	.....	1.43	.90	0.89	.....	.98	.80
4	.....	.....	.96	.90	.88	.97	1.00	19	.....	1.38	.90	.....	.90	1.00	.85
5	.....	1.75	.95	.90	.86	.97	1.00	20	.....	.....	.90	.89	.90	1.08	.90
6	.....	1.68	.93	.90	.85	.96	.98	21	.....	1.29	.90	.....	.90	.....	.....
7	.....	1.68	.92	.90	.83	.95	1.00	22	.....	1.27	.90	.....	.90	1.07	.95
8	.....	1.62	.90	.90	.83	.95	1.00	23	.....	1.22	.92	.89	.90	1.03	.96
9	.....	1.60	.90	.....	.82	.95	1.00	24	.....	1.19	.92	.89	.90	1.00	.97
10	.....	1.59	.90	.90	.82	.95	.98	25	1.88	1.17	.90	.89	.90	1.00	.....
11	.....	1.57	.88	.90	.82	.95	1.00	26	1.93	1.14	.90	.89	.90	.95	1.05
12	.....	1.55	.90	.....	.82	.94	1.00	27	1.88	1.10	.90	.89	.92	1.00	1.00
13	.....	1.56	.92	.90	.82	.94	1.00	28	1.80	1.08	.90	.89	.92	1.00	.97
14	.....	1.55	.92	.89	.82	.93	1.00	29	1.79	1.06	.90	.89	.93	1.00	.95
15	.....	1.55	.92	.89	.88	.92	.98	30	1.78	1.03	.....	.....	.....	1.00	.95
								31	.....	1.00	.90	.....	1.02	.....	.95

Rating table for Atanum Creek at Narrows, near Tampico, Wash., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	17	1.50	112
.90	25	1.60	134
1.00	35	1.70	157
1.10	46	1.80	181
1.20	59	1.90	206
1.30	74	2.00	232
1.40	92		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on three discharge measurements made during 1908 and is not well defined.

Monthly discharge of Atanum Creek at Narrows, near Tampico, Wash., for 1908.

[Drainage area, 116 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
June 25-30	214	176	192	1.66	0.37	2,280	B.
July	186	35	105	.905	1.04	6,460	B.
August	33	23	26.6	.229	.26	1,640	B.
September	25	24	24.4	.210	.23	1,450	B.
October	37	19	23.8	.205	.24	1,460	B.
November	44	27	33.2	.286	.32	1,980	B.
December	40	17	31.8	.274	.32	1,960	B.
The period						17,200	

ATANUM CREEK NEAR YAKIMA, WASH.

This station was established May 11, 1904, and was discontinued December 30 of the same year because of poor gaging conditions. Observations were again resumed August 27, 1907, at the same point. The present gage is located just above the Northern Pacific Railway bridge, and the measurements are made from the bridge during high water and by wading at low water.

The data obtained at this point are valuable in connection with a general study of the reclamation of the Yakima Valley now in progress by the United States Reclamation Service. The creek forms the northern boundary of the Yakima Indian reservation, and the waters are extensively used for the irrigation of Indian lands on the south side and for lands belonging to the white settlers on the north. Throughout the lower portions of the stream there is a considerable quantity of return water from irrigation which is measured at this station.

The station does not furnish favorable conditions, and the gage readings are not very good. The water at the gage is considerably disturbed by riffles. No ice forms to interfere with the determination of discharges.

Discharge measurements of Atanum Creek near Yakima, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 3	H. D. McGlashan	37	83	5.70	424
August 6	do	16	14	3.40	14
August 24	do	16	14	3.38	14
September 26[a]	J. C. Stevens	22	23	3.51	17
1908.					
April 15	H. D. McGlashan	17	33	4.50	102
June 17	J. C. Stevens	35.5	57	5.54	279
September 16[a]	L. R. Allen	18	11.6	3.34	10.4

[a] Measured by wading.

Daily gage height, in feet, of Atanum Creek near Yakima, Wash., for 1907 and 1908.

[Hugh Kennedy, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.											
1	.....	3.3	3.4	3.45	3.6	16	.....	3.4	3.4	3.45	3.8
2	.....	3.3	3.4	3.45	3.6	17	.....	3.4	3.4	3.45	3.8
3	.....	3.4	3.4	3.45	3.6	18	.....	3.4	3.4	3.45	3.75
4	.....	3.4	3.4	3.45	3.6	19	.....	3.4	3.4	3.45	3.75
5	.....	3.4	3.4	3.45	3.65	20	.....	3.4	3.4	3.45	3.8
6	.....	3.4	3.4	3.45	3.7	21	.....	3.4	3.4	3.5	3.8
7	.....	3.4	3.4	3.5	3.7	22	.....	3.4	3.4	3.5	3.8
8	.....	3.4	3.4	3.5	3.7	23	.....	3.4	3.4	3.5	3.8
9	.....	3.4	3.4	3.5	3.7	24	.....	3.4	3.4	3.5	3.85
10	.....	3.4	3.4	3.5	3.75	25	.....	3.4	3.4	3.55	3.9
11	.....	3.4	3.4	3.5	3.75	26	.....	3.45	3.4	3.6	3.9
12	.....	3.4	3.4	3.5	3.7	27	3.3	3.4	3.4	3.6	3.9
13	.....	3.4	3.4	3.5	3.75	28	3.3	3.4	3.4	3.6	3.9
14	.....	3.4	3.4	3.5	3.8	29	3.3	3.4	3.4	3.6	3.9
15	.....	3.4	3.4	3.45	3.9	30	3.3	3.4	3.4	3.6	3.9
						31	3.3	.....	3.4	.....	3.9

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1908.															
1	3.9	3.8	4.3	4.8	4.8	4.9	4.65	16	3.95	3.7	5.9	4.7	4.9	5.8	3.5
2	3.9	3.8	4.2	4.8	4.7	4.9	4.6	17	3.9	3.8	5.8	4.6	4.9	5.6	3.3
3	3.9	3.8	4.2	4.9	4.6	4.9	4.6	18	3.9	3.8	5.7	4.5	4.9	5.5	3.35
4	3.9	3.7	4.15	4.9	4.5	4.9	4.6	19	3.9	3.9	5.6	4.7	4.9	5.45	3.1
5	3.9	3.7	4.1	4.8	4.5	4.9	4.0	20	3.95	4.0	5.6	4.9	5.0	5.45	3.1
6	3.95	3.7	4.1	4.8	4.5	4.9	3.8	21	3.95	4.0	5.5	4.8	5.0	5.4	3.1
7	4.0	3.7	4.1	4.7	4.6	5.0	3.6	22	3.9	3.9	5.5	4.8	5.0	5.4	3.0
8	3.9	3.7	4.1	4.6	4.6	5.3	3.6	23	3.9	3.9	5.5	4.9	4.9	5.3	3.0
9	3.9	3.8	4.1	4.55	4.6	5.6	3.5	24	3.9	3.9	5.6	4.9	4.9	5.3	3.0
10	3.9	3.8	4.1	4.6	4.7	5.6	3.5	25	3.9	4.0	5.6	5.0	4.9	5.3	3.0
11	4.0	3.8	4.2	4.7	4.8	5.7	3.5	26	3.9	4.1	5.6	5.0	4.9	5.3	3.0
12	3.95	3.7	4.2	4.7	4.9	5.9	3.1	27	3.9	4.2	5.5	4.9	5.0	5.3	3.0
13	3.95	3.7	4.2	4.8	4.9	5.9	3.7	28	3.9	4.3	5.5	4.9	5.0	5.0	2.9
14	3.9	3.7	4.2	4.8	4.9	5.9	3.9	29	3.8	4.3	5.1	4.9	5.0	4.9	2.9
15	3.95	3.7	4.9	4.7	4.9	5.9	3.6	30	3.8	.....	5.0	4.9	4.9	4.6	2.9
								31	3.8	.....	4.9	.....	4.9	.....	2.9

NOTE.—Gage readings 1907–8 are not especially good, and for this reason gage heights August to December, 1908, are omitted altogether.

Rating table for Atanum Creek near Yakima, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	1.6	4.30	74
2.60	2.0	4.40	86
2.70	2.6	4.50	98
2.80	3.3	4.60	110
2.90	4.2	4.70	125
3.00	5.2	4.80	141
3.10	6.6	4.90	158
3.20	8.3	5.00	176
3.30	10.3	5.10	197
3.40	13	5.20	219
3.50	17	5.30	243
3.60	22	5.40	269
3.70	27	5.50	296
3.80	32	5.60	325
3.90	38	5.70	355
4.00	46	5.80	386
4.10	55	5.90	419
4.20	64	6.00	454

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1904–1908, and is fairly well defined above gage height 3.3 feet; below this it is only approximate.

Monthly discharge of Atanum Creek near Yakima, Wash., for 1907 and 1908.

[Drainage area, 212 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
August 27-31	10.3	10.3	10.3	0.049	0.01	102	B.
September	15	10.3	12.9	.061	.07	768	B.
October	13	13	13.0	.061	.07	799	B.
November	22	15	16.7	.079	.09	994	B.
December	38	22	30.8	.145	.17	1,890	B.
The period						4,550	
1908.							
January	46	32	38.8	.183	.21	2,390	B.
February	74	27	37.3	.176	.19	2,150	B.
March	419	55	189	.892	1.03	11,600	B.
April	176	98	136	.642	.72	8,090	B.
May	176	98	146	.689	.79	8,980	B.
June	419	110	261	1.23	1.37	15,500	B.
July	118	4.2	26.5	.125	.14	1,630	D.
The period						50,300	

SOUTH FORK OF ATANUM CREEK NEAR TAMPICO, WASH.

This station, which was established August 27, 1907, is located at Shanafelt's ranch, 2 miles above Tampico and 2½ miles above the junction with the North Fork. It is above all important diversions, but two or three small ditches divert water for individual tracts of land above the station.

The data obtained at this station are of value in connection with the use of the waters of the stream for irrigation by both Indian and white settlers. This portion of the river forms the northern boundary of the Yakima Indian Reservation.

It was impossible to find a favorable section for the accurate determination of the discharge. The banks of the stream are very thickly covered with willows and the channel is not permanent. The measurements are made by wading at any suitable point that can be found, or from a private bridge one-fourth mile below the gage when the river is high. There is a small by-channel whose waters do not pass the gage but are measured at the bridge. The discharge at the higher stages has been estimated by extending the discharge curve.

Discharge measurements of South Fork of Atanum Creek near Tampico, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 27 [a]	H. D. McGlashan	9.5	9	1.40	10
1908.					
May 2	H. D. McGlashan	17	12	1.97	51
June 26	J. C. Stevens	17	12	1.90	43
September 15	L. R. Allen	12	3.6	1.15	7.6
November 3	do	12	4	1.17	8.7

[a] Measured by wading.

Daily gage height, in feet, of South Fork of Atanum Creek near Tampico, Wash., for 1908.

[E. A. Shannafelt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					1.9			1.35	1.2	1.15	1.1	1.2
2	1.4				1.97	2.2		1.35	1.25	1.15	1.1	1.2
3	1.4	1.4			1.95	2.25		1.35	1.25	1.15	1.1	1.15
4	1.4				2.0	2.25		1.3	1.25	1.15	1.12	1.2
5	1.4	1.4			2.0	2.2	1.7	1.3	1.25	1.15	1.1	1.25
6		1.5			2.05	2.4	1.6	1.3	1.25	1.15	1.1	1.25
7					2.15		1.6	1.3	1.25	1.15	1.1	1.25
8					2.1		1.6	1.3	1.25	1.15	1.1	1.25
9	1.5				2.1		1.7	1.3	1.25	1.15	1.1	1.2
10	1.5	1.4			2.1		1.6	1.3	1.25	1.15	1.1	1.2
11	1.4				2.05		1.6	1.3	1.2	1.15	1.1	1.2
12					2.0	2.65	1.6	1.3	1.2	1.15	1.1	1.15
13					2.0	2.6	1.6	1.25	1.2	1.15	1.1	1.15
14	1.4				2.0	2.5	1.7	1.25	1.2	1.2	1.1	1.15
15					2.2	2.45	1.7	1.2	1.15	1.2	1.1	1.0
16					2.0	2.45	1.7	1.2	1.15	1.15	1.1	1.2
17	1.5	1.4			2.0	2.35	1.7	1.2	1.15	1.15	1.1	1.2
18		1.45			1.95	2.3	1.6	1.25	1.15	1.15	1.15	1.2
19					2.0	2.3	1.6	1.25	1.15	1.15	1.15	1.25
20					1.95	2.15	1.5	1.25	1.15	1.15	1.2	1.25
21					2.0	2.15	1.5	1.25	1.15	1.15	1.25	1.25
22						2.1	1.5	1.25	1.15	1.15	1.3	1.25
23					2.0	1.95	1.5	1.2	1.15	1.1	1.3	1.2
24					2.1	1.9	1.5	1.2	1.15	1.1	1.3	1.25
25					2.15	1.9	1.45	1.2	1.15	1.1	1.25	1.25
26	1.4			1.9	2.2	1.9	1.45	1.25	1.15	1.15	1.25	1.25
27				1.9	2.2	1.85	1.4	1.25	1.15	1.1	1.25	1.25
28				1.8	2.25	1.85	1.4	1.2	1.15	1.1	1.25	1.25
29			1.7		2.2	1.8	1.4	1.2	1.15	1.1	1.25	1.25
30			1.7		2.25	1.7	1.35	1.2	1.15	1.1	1.25	1.25
31			1.6		2.2		1.35	1.2		1.1		1.25

NOTE.—The following gage heights were observed during 1907: September 7, 16, and 29, 1.3 feet; September 14, 1.4 feet.

Rating table for South Fork of Atanum Creek near Tampico, Wash., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	4	1.50	22	2.00	52	2.50	101
1.10	6	1.60	27	2.10	60	2.60	113
1.20	9	1.70	32	2.20	68	2.70	126
1.30	13	1.80	38	2.30	78		
1.40	17	1.90	45	2.40	89		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1908 and is well defined between gage heights 1.1 feet and 2.0 feet.

Monthly discharge of South Fork of Atanum Creek near Tampico, Wash., for 1908.

[Drainage area, 28 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	22	17	18.7	0.668	0.77	1,150	B.
February 1-18	22	17	17.9	.639	.43	639	B.
May	73	45	57.3	2.05	2.36	3,520	B.
June	120	32	75.1	2.68	2.99	4,470	B.
July	32	15	25.6	.914	1.05	1,570	B.
August	15	9	11.3	.404	.47	695	B.
September	11	8	9.07	.324	.36	540	B.
October	9	6	7.55	.270	.31	464	B.
November	13	6	8.13	.290	.32	484	B.
December	11	4	9.74	.348	.40	599	B.
The period						14,100	

TOPPENISH CREEK NEAR TOPPENISH, WASH.

Toppenish Creek, which drains the northern part of the Yakima Indian Reservation, enters Yakima River from the west about 25 miles below the mouth of Atanum Creek.

This station, which was established October 31, 1909, to aid the United States Reclamation Service in its general study of the water supply available for the development of the Wapato project, is located at Prahl's ranch, 4 miles south and 4 miles west of Toppenish. After leaving the hills this river spreads into innumerable sloughs, which traverse the plains, and it is almost impossible to find a point where all the flow can be measured.

The conditions at this station, although not favorable for refined results, are such that the entire flow is measured except during extreme high water, when a slough one-half mile south of the station will probably carry some water. The station was abandoned March 3, 1909, in favor of a point just below the mouth of Simcoe Creek.

Discharge measurements of Toppenish Creek near Toppenish, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 31	L. R. Allen	20	59	2.01	65
November 19	do	20	63	2.22	69

Daily gage height, in feet, of Toppenish Creek, Toppenish, Wash., for 1908.

[J. C. Prahl, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		2.5	9	1.95	2.4	17	2.1	1.4	25	2.3	3.0
2		2.45	10	2.05	2.4	18	2.2	1.3	26	2.2	3.3
3		2.35	11	1.95	2.4	19	2.25	1.2	27	2.15	3.3
4		2.3	12	1.95	2.5	20	2.3	1.2	28	2.1	2.9
5		2.25	13	1.95	2.3	21	2.3	1.15	29	2.15	2.5
6		2.25	14	1.95	2.1	22	2.35	1.15	30	2.25	2.25
7		2.3	15	2.0	2.0	23	2.4	1.3	31		2.2
8	1.95	2.35	16	2.05	1.4	24	2.35	2.0			

SATUS CREEK NEAR TOPPENISH, WASH.

Satus Creek, which drains the southern part of the Yakima Indian Reservation, unites with Yakima River about 8 miles below the mouth of Toppenish Creek.

This station was established November 8, 1908, to obtain data for use by the United States Reclamation Service in connection with the development of the Wapato project, for which a knowledge of all streams draining the Yakima Reservation is of great importance. The station is located 4 miles west and 10 miles south of Toppenish, a short distance above the mouth of Dry Creek.

In general, conditions on this stream are not favorable for good results, but the station is located a short distance above a riffle control, where a stable relation between the gage heights and the flow can probably be determined. It is isolated, however, and very difficult to obtain continuous observations of gage heights, only weekly readings being possible at present.

Discharge measurements of Satus Creek near Toppenish, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 8	L. R. Allen	48	39	0.87	30
November 19	do	52	42	.93	34

The following gage heights were observed during 1908: November 6, 0.85 foot; November 15, 0.90 foot; November 22, 1.00 foot; November 29, 0.90 foot; December 6, 0.90 foot; December 13, 0.90 foot; December 20, 1.00 foot; December 27, 1.00 foot.

CANALS IN YAKIMA VALLEY.

NEW RESERVATION CANAL NEAR YAKIMA, WASH.

The New Reservation canal diverts water from the right bank of the Yakima River 6 miles below North Yakima and just below Union Gap.

The gaging station, which was established May 9, 1904, is located at a highway bridge 1,000 feet below the head-gate and above all diversions from the canal. The canal carries a small amount of water during the winter months for domestic uses, but the station records are of value only in connection with irrigation.

At present the canal is owned and operated by the United States Indian Service. The Wapato project of the United States Reclamation Service, by which the lands on the Yakima Indian Reservation will be irrigated, involves as one of its features the enlargement and extension of this canal.

The conditions at the station are not favorable for good results. The velocity of the water in the canal is slow, and on this account water grass grows profusely in the bed and on the banks of the canal, creating back-water conditions at the gage as the season advances. Several attempts have been made to get rid of this growth, as it interferes with the operation of the canal, but the attempts have been only partially successful. Discharges, therefore, must be obtained by the indirect method, which will give reasonably accurate results if a sufficient number of measurements are available.

The discharge at this station for 1908 has been added to that of the Old Reservation canal, the Sunnyside canal, and Yakima River at Wapato, to give the discharge of Yakima River at Union Gap, near Yakima.

Discharge measurements of New Reservation canal near Yakima, Wash., in 1905, 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 16	W. C. Muldrow		60	1.50	108
August 22	do		112	2.58	140
September 20	do			1.97	62
September 27	do		79	1.83	55
October 24	do		50	1.04	41
1906.					
March 22	J. C. Stevens	38	21	[a] .60	23
June 29	W. C. Muldrow	40	149	3.55	255
August 3	do	40	149	3.60	145
August 7	do	40	121	3.00	86
September 19	do	40	111	2.60	95
November 5	Muldrow and McGlashan	40	53	1.29	53
1907.					
March 26	H. D. McGlashan	36	23	.56	16
April 29	do	40	88	2.14	162
June 4	do	40	124	3.00	272
August 6	do	40	153	3.65	163
August 24	do	40	144	3.47	113
October 18	do	40	55	1.29	61
1908.					
April 15	H. D. McGlashan	40	104	2.50	214
May 4	do	40	133	3.14	306
June 17	J. C Stevens	39	128	3.13	230
July 9	C. F. Gleason	38.5	145	3.58	310
July 21	do	38.5	108	2.64	160
August 7	do	38.5	141	3.52	230
August 15	do	38.5	143	3.60	215
August 22	do	38	148	3.82	215
September 16	L. R. Allen	38	134	3.41	168
September 26	C. F. Gleason	37.5	88	2.20	88
October 29	L. R. Allen	38	46.5	1.09	34

[a] Gage height uncertain.

Daily gage height, in feet, of New Reservation canal near Yakima, Wash., for 1907 and 1908.

[W. H. Hall and P. Benson, observers.]

Day.	May.	June.	July.	August.	Day.	May.	June.	July.	August.
1907.					1907.				
1	2.3	3.0	3.1	3.75	16	3.2	3.1	3.85	.....
2	2.5	3.0	3.1	3.7	17	2.95	2.95	3.7	.....
3	2.5	3.0	3.0	3.7	18	2.95	2.95	3.7	.....
4	2.7	3.0	3.0	3.75	19	2.8	2.9	3.65	.....
5	2.7	3.1	3.1	3.7	20	2.8	2.9	3.65	.....
6	2.7	3.1	3.1	3.65	21	2.9	2.95	3.5	.....
7	2.8	3.2	3.3	3.65	22	2.7	2.95	3.55	.....
8	2.9	3.2	3.4	3.8	23	2.95	3.0	3.6	.....
9	3.0	3.1	3.6	3.8	24	2.9	3.0	3.65	.....
10	3.0	3.1	3.55	3.85	25	2.9	3.0	3.7	.....
11	3.0	3.1	3.6	.....	26	2.8	3.1	3.6	.....
12	2.9	3.1	3.7	.....	27	2.8	3.2	3.6	.....
13	2.85	3.2	3.7	.....	28	2.6	3.2	3.7	.....
14	2.7	3.2	3.8	.....	29	2.6	3.2	3.7	.....
15	2.92	3.2	3.85	.....	30	2.7	3.1	3.9	.....
					31	2.8	.....	3.9	.....

Day.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1908.									
1	.....	3.2	3.3	3.9	3.25	3.5	2.25	1.2	0.6
2	.....	3.2	3.3	3.9	3.25	3.58	2.55	1.1	.6
3	.....	.....	3.3	3.8	3.4	3.58	2.55	1.1	.6
4	.....	3.1	3.3	3.7	3.4	3.6	2.55	1.0	.6
5	.....	3.1	3.3	3.7	3.6	3.6	2.5	1.0	.6
6	.....	3.1	3.3	3.7	3.6	3.5	2.5	1.0	.6
7	.....	3.4	.....	3.65	3.53	3.4	2.5	1.0	.6
8	.....	3.4	3.8	3.63	3.53	3.36	2.5	1.0	.6
9	.....	3.4	3.0	3.6	3.53	3.3	2.48	.9	.6
10	.....	.....	3.0	3.8	3.6	3.28	2.45	.9	.6
11	.....	3.3	3.0	3.75	3.6	3.28	2.45	.9	.6
12	.....	3.3	3.0	3.75	3.6	3.28	2.4	.9	.6
13	.....	3.3	3.0	3.8	3.6	3.28	2.4	.8	1.4
14	.....	.....	.....	3.8	3.6	3.3	2.35	.8	1.4
15	2.5	3.2	3.0	4.0	3.6	3.4	2.2	.8	1.4
16	2.7	3.2	3.0	2.7	3.55	3.4	2.6	.8	1.4
17	.....	.....	3.1	2.7	3.55	3.2	2.0	.8	1.3
18	2.7	3.2	3.1	2.7	3.55	3.2	2.0	.8	1.2
19	.....	3.2	3.1	2.7	3.6	3.2	2.0	.8	1.0
20	2.9	3.2	3.0	2.7	3.6	3.2	1.95	.8	1.0
21	.....	3.2	3.0	2.7	3.8	3.15	1.95	.8	.9
22	2.7	3.1	3.0	3.0	3.75	3.15	1.9	.8	.9
23	2.7	3.1	2.9	3.0	3.7	3.1	1.9	.7	.8
24	2.7	.....	2.9	3.4	3.6	3.1	1.9	.7	.8
25	2.7	3.3	2.9	3.4	3.5	2.1	1.85	.7	.6
26	.....	3.3	3.4	3.4	3.5	2.1	1.8	.7	.6
27	2.7	3.3	3.4	3.5	3.5	2.1	1.8	.7	.6
28	.....	3.3	3.4	3.25	3.48	2.25	1.9	.7	.6
29	2.7	3.3	3.4	3.45	3.48	2.25	1.9	.7	.6
30	.....	3.3	3.4	3.4	3.48	2.25	1.2	.7	.6
31	.....	.....	.....	3.3	3.5	.....	1.2	.....	.6

Daily discharge, in second-feet, of New Reservation canal near Yakima, Wash., for 1905, 1906, 1907, and 1908.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1905.					1905.				
1	93	111	134	60	16	111	148	134	.....
2	93	111	138	62	17	111	145	138	.....
3	93	114	142	.....	18	114	142	142	.....
4	72	120	152	.....	19	114	142	166	.....
5	70	120	159	.....	20	114	138	142	.....
6	70	131	159	.....	21	114	138	134	.....
7	75	138	159	.....	22	114	131	131	.....
8	78	156	156	.....	23	114	131	131	.....
9	96	142	148	.....	24	114	134	131	.....
10	99	145	148	.....	25	96	134	131	.....
11	99	148	145	.....	26	96	134	87	.....
12	105	148	142	.....	27	96	138	87	.....
13	105	148	138	.....	28	68	142	72	.....
14	105	152	138	.....	29	96	142	68	.....
15	105	145	138	.....	30	99	134	60	.....
					31	.....	134	65	.....

Day.	April.	May.	June.	Aug.	Sept.	Oct.	Day.	April.	May.	June.	Aug.	Sept.	Oct.
1906.							1906.						
1	.....	166	201	152	50	111	16	.....	208	194	60	87	117
2	.....	173	201	152	50	111	17	.....	194	187	60	87	117
3	.....	180	208	145	55	111	18	.....	194	187	96	93	124
4	.....	180	208	138	55	111	19	.....	187	187	50	93	50
5	.....	180	215	131	55	117	20	.....	187	0	50	99	50
6	.....	194	0	131	60	117	21	.....	194	0	50	99	50
7	.....	0	201	81	60	117	22	117	201	187	45	105	50
8	.....	201	0	81	65	117	23	131	208	208	45	105	50
9	.....	201	194	33	65	117	24	124	215	201	45	105	50
10	.....	201	194	30	70	117	25	131	215	215	45	105	50
11	.....	208	0	27	70	117	26	145	222	229	45	105	50
12	.....	208	187	27	75	117	27	131	215	252	45	111	50
13	.....	201	180	27	75	117	28	145	201	252	45	111	50
14	.....	201	180	65	81	117	29	145	201	260	45	111	50
15	.....	208	194	60	81	117	30	166	201	260	45	111	50
							31	.....	201	.....	50	.....	50

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1907.					1907.				
1	173	268	260	219	16	268	276	280	.....
2	187	268	260	215	17	248	264	268	.....
3	194	268	252	215	18	248	264	260	.....
4	208	268	252	212	19	244	260	256	.....
5	208	276	252	208	20	244	260	248	.....
6	215	276	252	198	21	252	264	236	.....
7	222	284	268	198	22	236	264	240	.....
8	229	284	268	201	23	256	260	236	.....
9	236	276	284	194	24	252	260	240	.....
10	244	276	280	198	25	260	260	244	.....
11	244	276	276	.....	26	252	268	229	.....
12	236	276	284	.....	27	252	276	229	.....
13	240	284	284	.....	28	236	276	229	.....
14	229	284	284	.....	29	236	268	229	.....
15	246	284	288	.....	30	244	260	236	.....
					31	252	.....	236	.....

Daily discharge, in second-feet, of New Reservation canal near Yakima, Wash., for 1905, 1906, 1907, and 1908—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.									
1	.....	306	289	339	209	166	108	39	18
2	.....	304	287	338	205	176	141	35	18
3	.....	297	286	324	222	178	142	35	18
4	.....	289	286	308	218	180	142	31	18
5	.....	287	285	308	240	180	138	31	18
6	.....	286	283	307	236	169	138	31	18
7	.....	327	317	300	224	156	138	31	18
8	.....	325	352	297	222	153	139	31	18
9	.....	324	239	293	218	146	136	28	18
10	.....	317	238	321	224	144	133	28	18
11	.....	310	238	313	222	144	133	28	18
12	.....	308	236	311	218	146	128	28	18
13	.....	307	235	318	215	147	128	24	39
14	.....	300	234	317	213	150	123	24	39
15	224	292	234	345	209	166	102	24	39
16	250	290	232	167	198	172	150	24	39
17	249	289	244	167	196	153	89	24	44
18	248	289	243	166	192	159	89	24	39
19	262	287	243	166	196	166	89	24	31
20	275	286	228	165	192	171	85	24	31
21	260	286	227	164	215	172	85	24	28
22	244	271	226	201	205	179	81	24	28
23	243	269	212	200	197	186	81	21	24
24	241	283	212	251	183	186	81	21	24
25	241	296	209	248	169	83	77	21	18
26	240	296	275	245	167	85	74	21	18
27	240	294	275	257	167	88	74	21	18
28	239	292	273	221	164	102	82	21	18
29	238	290	272	244	164	105	83	21	18
30	272	290	271	235	164	107	39	21	18
31	.....	289	.....	218	166	.....	39	.....	18

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of New Reservation canal near Yakima, Wash., for 1905, 1906, 1907, and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1905.					
June	114	70	97.6	5,810	B.
July	156	111	137	8,420	B.
August	166	60	130	7,990	C.
The period	.....	.....	.....	22,200	
1906.					
April 22–30	166	117	137	2,450	C.
May	222	0	192	11,800	B.
June	260	0	173	10,300	B.
July	.....	.....	.....	.....	
August	152	27	67.8	4,170	B.
September	111	50	83.1	4,940	B.
October	124	50	88.4	5,440	B.
The period	.....	.....	.....	39,100	
1907.					
May	268	173	235	14,400	B.
June	284	260	271	16,100	B.
July	288	229	256	15,700	B.
August 1–10	219	194	206	14,100	B.
The period	.....	.....	.....	50,300	

Monthly discharge of New Reservation canal near Yakima, Wash., for 1905, 1906, 1907, and 1908—Continued.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
April 15-30	275	224	248	7,870	B.
May	327	269	296	18,200	B.
June	352	209	256	15,200	B.
July	345	164	260	16,000	B.
August	240	164	201	12,400	B.
September	186	83	152	9,040	B.
October	142	39	105	6,460	B.
November	39	21	26.1	1,550	B.
December	44	18	24.1	1,480	B.
The period				88,200	

OLD RESERVATION CANAL NEAR WAPATO, WASH.

This canal was constructed and is operated by the United States Indian Service for the benefit of Indian lands on the Yakima Reservation.

A station was first established June 7, 1904, at the Northern Pacific Railway bridge about 1 mile below the head gate. There is a slough carrying considerable water that is taken into this canal at a point 280 feet below the head gate. It is carried to a point about 1,000 feet farther down the canal and there returned to the slough, which continues parallel to the river and forms both a waste way for the canal and a channel from which diversions are made for irrigation. On June 23, 1908, a new station was established 300 feet below the head gate of the canal and below the point where the waters from the slough are received, and just above the first diversion. The records at this point are not comparable with those formerly obtained at the railroad bridge, but they represent the amount of water taken from the Yakima River. The discharges at the railroad bridge have been used to estimate the diversions from the Yakima River for May, June, November, and December, 1908, as the records at the intake do not cover these results.

Little choice was offered in the selection of the station, as the range where all the inflow could be measured above all diversions was only about 50 feet in length. The velocity at this point is sufficiently swift to prevent the growth of weeds, but it also has the effect of changing the channel when a large head is diverted into the canal. For the purposes for which the station was established the data are sufficiently accurate.

The data are valuable in connection with irrigation and also have an important bearing on the general hydrographic studies of the Yakima River system. The discharge at this station during 1908 has been added to that of Sunnyside canal, the New Reservation

canal, and Yakima River at Wapato, to obtain the discharge of Yakima River at Union Gap.

Discharge measurements of Old Reservation canal near Wapato, Wash., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 26	H. D. McGlashan	.....	.....	0.50	[a] 0.8
April 29	do	14	41	3.20	187
June 4	do	14	41	3.15	197
August 6	do	14	27	2.20	85
August 24	do	14	30	2.45	118
October 18	do	14	25	1.99	82

[a] Estimated.

Daily gage height, in feet, of Old Reservation canal near Wapato, Wash., for 1907.

[Jacob Kaler, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	3.9	3.9	2.6	.....	17	4.0	.....	3.3	2.0	.....
2	.....	3.9	3.8	2.5	2.4	18	4.0	.....	3.3	.....	.....
3	.....	.....	3.8	2.4	2.4	19	.....	.....	3.3	2.0	.....
4	.....	3.15	.....	.....	2.4	20	4.0	.....	3.3	2.0	.....
5	.....	.....	3.8	2.4	2.4	21	4.0	.....	.....	2.0	.....
6	4.0	.....	3.7	2.4	2.3	22	4.0	.....	3.3	2.0	.....
7	4.0	.....	.....	2.4	2.3	23	4.0	.....	3.3	2.0	.....
8	4.0	.....	3.6	2.3	.....	24	4.0	3.9	3.3	2.0	.....
9	3.9	.....	3.6	.....	2.3	25	3.9	3.9	3.3	.....	.....
10	3.9	.....	3.4	2.9	2.3	26	3.9	3.9	3.2	2.0	.....
11	3.9	.....	3.4	.....	2.3	27	3.9	3.9	.....	2.0	.....
12	.....	.....	3.4	2.8	2.3	28	3.9	3.9	2.2	2.0	.....
13	3.9	.....	3.4	2.6	2.3	29	3.9	3.9	2.2	2.0	.....
14	3.9	.....	.....	2.6	2.4	30	3.9	.....	2.2	2.3	.....
15	3.9	.....	3.3	2.3	2.4	31	3.9	.....	2.2	.....	.....
16	3.9	.....	3.3	2.2	.....						

NOTE.—The water was turned in April 4. The patrol of the canal was discontinued September 15.

Daily gage height, in feet, of Old Reservation canal near Wapato, Wash., for 1908.

[P. Benson, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.7	3.3	3.7	2.7	2.75	1.8	1.6	1.3
2	.....	3.7	3.3	3.7	2.7	2.7	1.8	1.6	1.3
3	.....	3.7	3.3	3.6	2.7	2.7	1.8	1.6	1.3
4	.....	3.7	3.3	3.6	2.8	2.7	1.8	1.6	1.3
5	.....	3.7	3.5	3.6	2.8	2.7	1.8	1.6	1.3
6	.....	3.7	3.5	3.54	2.8	2.55	1.8	1.6	1.3
7	.....	3.7	3.5	3.5	2.8	2.55	1.8	1.6	1.3
8	.....	3.7	3.8	3.8	2.9	2.5	1.8	1.6	1.3
9	.....	3.7	3.8	3.8	2.9	2.4	1.8	1.4	1.3
10	.....	3.7	3.0	3.8	2.86	2.3	1.75	1.4	1.3
11	.....	3.7	3.0	3.8	2.85	2.3	1.75	1.4	1.3
12	.....	3.7	3.0	3.8	2.8	2.3	1.75	1.4	1.3
13	.....	3.7	3.0	3.8	2.8	2.3	1.75	1.4	1.3
14	.....	3.7	3.0	3.6	2.8	2.3	1.75	1.4	1.3
15	3.5	3.7	3.0	3.8	2.76	2.4	1.75	1.4	1.3
16	3.5	3.7	2.9	2.9	2.7	2.5	1.75	1.4	1.3
17	3.5	3.7	2.9	2.85	2.7	2.6	1.75	1.4	1.3
18	3.5	3.7	2.8	2.8	2.6	2.2	1.75	1.4	1.3
19	4.0	3.7	3.0	2.8	2.5	2.2	1.75	1.4	1.3
20	3.7	3.6	3.0	2.78	2.5	2.2	1.7	1.4	1.3

Daily gage height, in feet, of Old Reservation canal near Wapato, Wash., for 1908—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	3.6	3.6	3.0	2.78	2.7	2.2	1.7	1.4	1.0
22	3.5	3.4	3.0	2.75	2.65	2.15	1.7	1.4	1.0
23	3.5	3.4	3.1	2.7	2.65	2.1	1.7	1.35	1.0
24	3.5	3.4	3.1	2.65	2.54	2.1	1.7	1.3	1.0
25	3.5	3.3	3.1	2.6	2.5	2.1	1.65	1.3	.9
26	3.5	3.3	3.6	2.55	2.5	2.1	1.6	1.3	.9
27	3.5	3.3	3.6	2.5	2.5	2.1	1.6	1.3	.9
28	3.6	3.3	3.5	2.5	2.6	2.0	1.6	1.3	.9
29	3.6	3.3	3.5	2.5	2.6	1.8	1.6	1.3	.9
30	3.6	3.3	3.5	2.45	2.6	1.8	1.6	1.3	.8
31	.....	3.3	.....	2.4	2.8	.....	1.6	.....	.8

Rating table for Old Reservation canal near Wapato, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	1	1.40	40	2.30	105	3.20	200
.60	4	1.50	46	2.40	114	3.30	214
.70	7	1.60	52	2.50	123	3.40	228
.80	11	1.70	59	2.60	132	3.50	242
.90	15	1.80	66	2.70	142	3.60	258
1.00	20	1.90	73	2.80	153	3.70	274
1.10	25	2.00	80	2.90	164	3.80	290
1.20	30	2.10	88	3.00	175	3.90	307
1.30	35	2.20	96	3.10	187	4.00	324

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1907, and is fairly well defined.

Monthly discharge of Old Reservation canal near Wapato, Wash., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
May 6–31	324	307	314	16,200	B.
June	307	194	247	14,700	B.
July	307	96	217	13,300	B.
August	164	80	105	6,460	B.
September 1–15	114	105	109	3,240	B.
The period	.....	.....	.....	53,900	
1908.					
April 15–30	324	242	253	8,030	B.
May	274	214	255	15,700	B.
June	290	153	207	12,300	B.
July	290	114	204	12,500	B.
August	164	123	142	8,730	B.
September	148	66	108	6,430	B.
October	66	52	60.5	3,720	B.
November	52	35	42.0	2,500	B.
December	35	11	28.3	1,740	B.
The period	.....	.....	.....	71.600	

Discharge measurements of Old Reservation canal at intake, near Wapato, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 23	J. C. Stevens	18	76	3.09	198
July 9	C. F. Gleason	19	85	3.52	245
July 21	do	17	58	2.02	135
August 7	do	17	60	2.17	147
August 15	do	17	58	2.06	134
August 22	do	17	56	1.98	137
September 16	L. R. Allen	17	54	1.82	118
September 26	C. F. Gleason	16.5	43	1.21	82
October 29	L. R. Allen	16	34	.60	45.3

Daily gage height, in feet, of Old Reservation canal at intake, near Wapato, Wash., for 1908.

[Thos. J. Lynch, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			1.75	2.15			17					0.90	
2		3.52					18		2.00		1.90		
3							19			1.70	1.40		
4		3.34	1.90				20					1.00	
5			2.00				21					.80	
6		3.20					22						
7		3.30				0.70	23	3.09	1.90				
8			2.20	1.90	0.75	.40	24				1.25	.60	
9		3.35			.75		25						
10							26			1.80	.40		
11		3.40	2.00				27						
12			2.10				28		1.70				
13							29	3.02					
14		3.45	2.20	1.50			30		1.60			.70	
15		2.90	2.10				31						
16		2.32											

Rating table for Old Reservation canal at intake near Wapato, Wash., for 1908

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	36	1.30	88	2.20	148	3.10	212
.50	41	1.40	94	2.30	155	3.20	220
.60	46	1.50	100	2.40	162	3.30	228
.70	52	1.60	106	2.50	169	3.40	236
.80	58	1.70	113	2.60	176	3.50	244
.90	64	1.80	120	2.70	183	3.60	252
1.00	70	1.90	127	2.80	190		
1.10	76	2.00	134	2.90	197		
1.20	82	2.10	141	3.00	204		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 9 discharge measurements made during 1908, and is well defined.

Monthly discharge of Old Reservation canal at intake, near Wapato, Wash., for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
June 23–30	220	206	210	3,330	A.
July	246	108	176	10,800	A.
August	148	113	130	7,990	A.
September	144	36	99.5	5,920	A.
October	70	44	54.5	3,350	B.
The period				31,400	

NOTE.—The discharge at this station for July to October is about 90 per cent of that at the old station just below. The discharge has therefore been estimated as 230 second-feet for May and 186 second-feet for June. For November and December the discharge has been assumed to have been the same as at the old station.

SUNNYSIDE CANAL NEAR WAPATO, WASH.[a]

This station was established April 22, 1904, although records of flow of the canal have been kept ever since it has been in operation. It is located 500 feet below the intake, and above all deliveries.

The Sunnyside canal (Pl. VI) was purchased by the United States Reclamation Service in July, 1906. It is at present somewhat over 60 miles in length and irrigates nearly 42,000 acres of land. There are over 250 diversions from the main canal, one lateral—Snipes Mountain—being nearly 15 miles in length. In its general direction the canal parallels Yakima River, traversing the country at right angles to the drainage lines. The operation of this system requires that hydrographic work of an exceptional degree of accuracy be carried on. During the irrigating season the general scheme of operation is effected by dividing the canal and the main laterals into beats, varying from 3 to 8 miles in length, each in charge of a patrolman. Gaging stations are maintained at the extremities of the beats, where the daily flow is obtained. The amount diverted from the main canal is also measured by means of weirs or special measuring boxes. A complete discussion of the very interesting data that have been obtained on this canal system is too lengthy for inclusion in this report, and only the quantity of water diverted from Yakima River as measured at the intake is presented in detail. A summary of the results obtained at other points on the canal is given and contains some very interesting data on evaporation and seepage (see below). Seepage investigations were made both on the main canal and on certain laterals especially chosen for that purpose.

A new inclined gage was installed April 6, 1907, but the gage heights for this year refer to the old vertical staff gage used in 1906. On July 31, 1907, a gaging bridge was erected 600 feet below the intake of the canal. In the spring of 1908 a new gage was installed just above this bridge and at a different datum. Measurements and gage heights for 1908 are referred to this gage.

Mean discharge of Sunnyside canal at various points and the mean losses therefrom during the five months May to September, 1908.

Beat.	Station.	Inflow.	Outflow.	Difference.	Diversions.	Loss.		
						Sec.-ft.	Per cent of inflow.	Sec.-ft. per acre of canal bed.
		Sec.-ft.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*			
1	0 to 8 mile	612	563	49	15	34	5.6	0.79
2	8 to 17 mile	563	516	47	66	[b]19	4.2	.....
3	17 to 25 mile	516	451	65	55	10	1.9	.25
4	25 to 30 mile	451	296	155	134	21	4.7	.93
5	30 to 38 mile	296	231	65	49	16	5.4	.53
6	38 to 42 mile	231	197	34	28	6	2.6	.32
7	42 to 48 mile	197	93	104	82	22	11.2	1.19
8	48 to 52 mile	93	44	49	48	1	1.1	.11
9	52 to 56 mile	44	7	37	28	9	20.9	1.38

[a] Formerly referred to as near Yakima.
[b] Gain; due to unmeasured accretions to the flow from upland drainage and seepage from land above the canal irrigated from another canal.

Comparison of losses from main Sunnyside canal with those from certain smaller laterals in the system.

Seepage unit.	Loss in second-feet per acre of canal bed.	Nature of soil.
Lateral 20.50	1.05	Volcanic ash.
Lateral 22.62, main	.78	Sand.
Lateral 22.62, west branch	.68	Sandy ash.
Lateral 22.62, south branch	.64	Sandy loam.
Lateral 29.65	.63	Sand and ash.
Lateral 42.62	.84	Sand.
Main canal, 0 to 8 mile	.79	Volcanic ash.
Main canal, 25 to 30 mile	.93	Sand and ash.
Main canal, 30 to 38 mile	.53	Ash and loam.
Main canal, 42 to 48 mile	1.19	Sand.
Main canal, 52 to 56 mile	1.38	Porous lava soil.

Discharge measurements of Sunnyside canal near Wapato, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	H. D. McGlashan	40	162	[a] 5.54	198
May 3	do	45	244	[a] 7.56	494
June 4	do	46	249	4.53	538
August 16	I. E. Oakes		184	4.25	474
August 31	do		199	4.60	489
Do	do		192	4.40	478
September 7	do		174	4.00	430
September 16	do		217	5.00	578
Do	do		162	3.80	401
September 26	do		157	3.60	371
October 4	do		148	3.40	326
Do	do		140	3.20	303
Do	do		131	3.00	282
October 5	do		122	2.80	257
Do	do		113	2.60	215
Do	do		105	2.40	190
Do	do		97	2.20	157
Do	do		89	2.00	139
1908.					
March 18	I. E. Oakes	36	57	1.18	80
March 21	do	39	77	1.62	121
March 28	do	38	91	2.10	172
April 10	J. C. Stevens	43	148	3.40	380
April 28	I. E. Oakes	46	202	4.58	601
May 14	do	48	208	4.68	599
June 19	J. C. Stevens	48	213	4.71	603
July 17	I. E. Oakes	48	212	4.70	601
July 22	L. R. Allen	46	194	4.67	585
July 30	do	49	213	4.70	605
September 7	I. E. Oakes	46	213	4.80	605
September 16	L. R. Allen	46	212	4.80	597

[a] Referred to inclined gage.

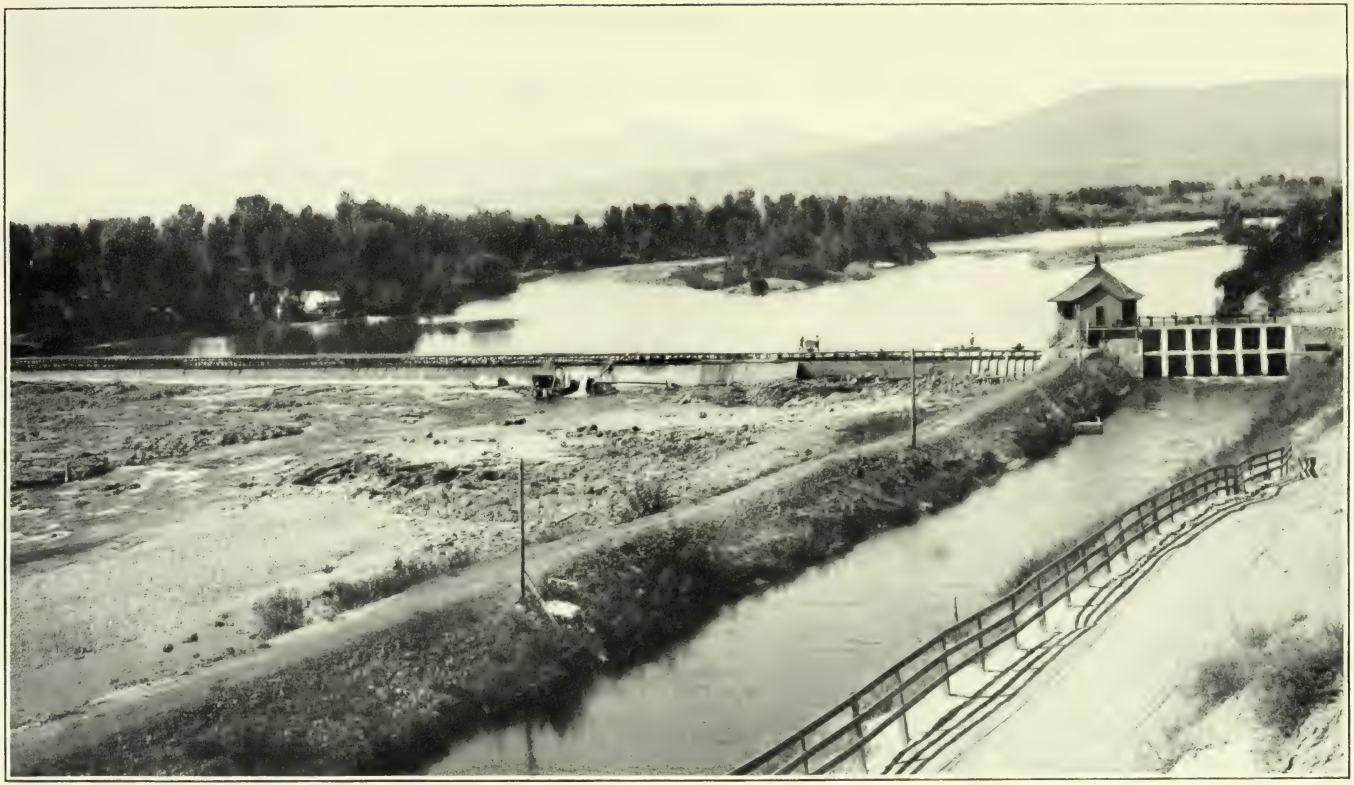
NOTE.—Measurements for 1908 refer to new gage located just above the gaging bridge.

Daily gage height, in feet, of Sunnyside canal near Wapato, Wash., for 1906 and 1907.

[George Hans, observer.]

Day.	1906.	1907.						
	Oct. [a]	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.8	2.1	4.25	4.5	4.55	4.8	4.4	3.75
2	3.8	2.2	4.25	4.5	4.55	4.7	4.0	3.75
3	3.8	2.2	4.25	4.5	4.55	4.7	4.2	3.75
4	3.8	2.4	4.35	4.5	4.55	4.7	4.2	3.75
5	3.8	2.4	4.35	4.5	4.55	4.65	4.1	3.75

[a] Gage heights for October, 1906, were omitted from the 1906 report.



SUNNYSIDE CANAL HEADING, YAKIMA PROJECT, WASHINGTON.

Daily gage height, in feet, of Sunnyside canal near Wapato, Wash., for 1906 and 1907—Continued.

Day.	1906.	1907.						
	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
6	3.8	2.4	4.35	4.5	4.6	4.65	4.0	3.75
7	3.8	2.4	4.35	4.5	4.6	4.65	4.0	3.75
8	3.3	2.4	4.45	4.5	4.6	4.65	4.0	3.75
9	3.7	2.4	4.45	4.5	3.2	4.65	4.1	3.75
10	3.7	2.4	4.5	4.5	3.2	4.65	4.1	3.75
11	3.7	2.6	4.5	4.45	3.4	4.65	4.1	3.75
12	3.7	2.75	4.5	4.45	4.65	4.65	4.1	3.75
13	3.7	2.75	4.5	4.35	4.65	4.65	4.0	3.75
14	3.7	2.85	4.5	4.35	4.65	4.65	3.9	3.65
15	3.7	2.85	4.5	4.25	4.7	4.35	3.9	3.65
16	3.7	2.85	4.5	4.0	4.7	4.25	3.8	3.65
17	3.7	3.05	4.5	4.0	4.8	4.2	3.8	3.65
18	3.7	3.15	4.5	4.0	4.8	4.2	3.8	3.65
19	3.7	3.15	4.5	4.2	4.8	4.2	4.0	3.65
20	3.7	3.15	4.55	4.3	4.8	4.6	3.9	3.65
21	3.7	3.25	4.55	4.3	4.85	4.7	3.9	3.65
22	3.7	3.25	4.55	4.3	4.85	4.7	3.9	3.75
23	3.7	3.55	4.55	4.3	4.85	4.8	3.9	3.75
24	3.6	3.75	4.5	4.3	4.85	4.8	3.9	3.75
25	3.6	3.85	4.4	4.3	4.9	4.8	3.9	3.75
26	3.6	3.85	4.4	4.3	4.9	4.8	3.9	3.75
27	3.6	3.95	4.4	4.4	4.9	4.8	3.75	3.75
28	3.6	4.05	4.4	4.4	4.9	4.8	3.75	3.75
29	3.6	4.15	4.4	4.55	4.9	4.7	3.75	3.75
30	3.6	4.15	4.4	4.55	4.85	4.7	3.75	3.75
31	3.6	.....	4.4	.....	4.8	4.6	.....	3.75

Daily gage height, in feet, of Sunnyside canal near Wapato, Wash., for 1908. [a]

[W. R. Newland, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.6	4.7	4.8	4.8	4.8	4.6	3.2
2	.....	4.6	4.7	4.8	4.8	4.8	4.6	.....
3	.....	4.6	4.7	4.8	4.8	4.8	4.6	.....
4	.....	4.6	4.7	4.8	4.8	4.8	4.6	.....
5	.....	4.6	4.7	4.8	4.8	4.8	4.6	.....
6	2.9	4.6	4.7	4.85	4.85	4.8	4.6	.....
7	2.95	4.65	4.7	4.9	4.9	4.8	4.2	.....
8	3.1	4.7	4.7	4.9	4.9	4.8	4.0	.....
9	3.4	4.7	4.7	4.9	4.9	4.8	4.0	.....
10	3.4	4.7	4.7	4.9	4.9	4.8	4.0	.....
11	3.5	4.7	4.7	4.9	4.9	4.8	4.0	.....
12	3.75	4.7	4.7	4.9	4.95	4.8	4.0	.....
13	4.0	4.7	4.7	3.9	5.0	4.8	4.0	.....
14	4.2	4.7	4.7	4.5	5.0	4.8	4.0	.....
15	4.35	4.7	4.7	4.5	5.0	4.8	4.0	.....
16	4.4	4.7	4.7	4.4	5.0	4.8	4.0	.....
17	4.4	4.7	4.7	4.7	5.0	4.8	4.0	.....
18	4.4	4.7	4.7	4.7	5.0	4.8	4.0	.....
19	4.4	4.7	4.7	4.7	5.0	4.8	4.0	.....
20	4.4	4.7	4.7	4.7	5.0	4.8	4.0	.....
21	4.45	4.7	4.7	4.7	5.0	4.8	4.0	.....
22	4.5	4.7	4.7	4.7	5.0	4.8	4.0	.....
23	4.5	4.7	4.7	4.7	5.0	4.8	4.0	.....
24	4.6	4.7	4.7	4.7	5.0	4.8	4.0	.....
25	4.6	4.7	4.7	4.7	5.0	4.8	4.0	.....
26	4.6	4.7	4.7	4.7	4.95	4.8	4.0	.....
27	4.6	4.7	4.7	4.7	4.9	4.8	4.0	.....
28	4.6	4.7	4.7	4.7	4.85	4.6	4.0	.....
29	4.6	4.7	4.7	4.7	4.8	4.6	4.0	.....
30	4.6	4.7	4.7	4.7	4.8	4.6	4.0	.....
31	.....	4.7	.....	4.7	4.8	.....	4.0	.....

[a] Gage heights for 1908 refer to a new gage just above the gaging bridge.

Rating tables for Sunnyside canal near Wapato, Wash.

1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	151	2.90	258	3.70	383	4.50	511
2.20	163	3.00	273	3.80	399	4.60	527
2.30	176	3.10	288	3.90	415	4.70	543
2.40	189	3.20	303	4.00	431	4.80	559
2.50	202	3.30	319	4.10	447	4.90	575
2.60	216	3.40	335	4.20	463		
2.70	230	3.50	351	4.30	479		
2.80	244	3.60	367	4.40	495		

1908.[b]

2.90	292	3.50	393	4.10	496	4.70	604
3.00	308	3.60	410	4.20	514	4.80	623
3.10	325	3.70	427	4.30	532	4.90	642
3.20	342	3.80	444	4.40	550	5.00	661
3.30	359	3.90	461	4.50	568		
3.40	376	4.00	478	4.60	586		

[a] This table is based on 16 discharge measurements made during 1907 and is well defined.
[b] This table is based on 12 discharge measurements made during 1908 and is well defined.

Monthly discharge of Sunnyside canal near Wapato, Wash., for 1906 to 1908.

Month.	Discharge in second-feet.			Total run-off in acre feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.					
April	579	12	318	18,900	B.
May	594	540	583	35,800	B.
June	638	33	499	29,700	B.
July	704	627	684	42,100	B.
August	572	398	476	29,300	B.
September	467	334	414	24,600	B.
October [a]	408	317	386	23,700	B.
The period				204,000	
1907.					
April	455	151	279	16,600	A.
May	519	471	501	30,800	A.
June	519	431	490	29,200	A.
July	575	303	526	32,300	A.
August	559	463	531	32,600	A.
September	495	391	424	25,200	A.
October	391	375	387	23,800	A.
The period				190,000	
1908.					
April 6–30	586	292	503	24,900	A.
May	604	586	600	36,900	A.
June	604	604	604	35,900	A.
July	642	461	607	37,300	A.
August	661	623	645	39,700	A.
September	623	586	619	36,800	A.
October	586	478	500	30,700	A.
November			75	4,460	D.
The period				247,000	

[a] Discharges for October were omitted from 1906 report.

NOTE.—Discharge for November, 1908, estimated. There may also have been a small amount of flow during December, 1908.

KIONA CANAL NEAR KIONA, WASH.

This canal diverts water from the left bank of Yakima River, 5 miles upstream from Kiona, in sec. 10, T. 9 N., R. 20 E. It is operated by the Northern Pacific Irrigating Company. The first systematic measurements were made in 1904, the station being established June 6. The records were interrupted during 1906–7 but were begun again on May 7, 1908.

The principal value of the records is in making a study of the discharge of Yakima River at Prosser. A station was established at Prosser May 30, 1904, but on account of the impossibility of measuring the discharge at low water the station was abandoned on December 12, 1906. The flow is under the artificial control of the power plant and mills located here. The station on Kiona canal was therefore established with the intention of accounting for the inflow and diversions between Prosser and Kiona, since at the latter point reliable discharge records of long standing are available. The data herewith represents the amount diverted from Yakima River at this point.

Discharge measurements of Kiona canal near Kiona, Wash., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
May 7	H. D. McGlashan	5.9	12	2.05	33
September 9	L. R. Allen	6	14	2.26	26
September 10	do	6	9.9	1.65	16

Daily gage heights at Kiona canal near Kiona, Wash., 1908.

[M. A. McBean, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.09	2.13	2.30	2.10	1.83	16	2.00	2.43	1.90	2.16	2.13	1.40
2	.....	2.08	2.15	2.20	2.10	1.80	17	2.00	2.43	1.90	2.10	2.14	1.40
3	.....	2.08	2.25	2.13	1.95	1.80	18	2.00	2.41	1.88	1.98	2.14	1.40
4	.....	2.08	2.39	1.85	1.95	1.79	19	2.00	2.38	1.88	1.90	2.01	1.40
5	.....	2.08	2.39	2.00	1.95	1.78	20	2.00	2.33	1.80	1.83	2.00	1.20
6	.....	.....	2.35	2.10	2.05	1.70	21	2.00	2.22	1.80	1.75	1.95	1.20
7	2.05	.....	2.35	2.04	2.05	1.70	22	2.00	2.18	2.00	1.90	1.93	1.20
8	2.03	.....	2.28	2.23	2.05	.....	23	2.00	2.13	2.00	2.10	1.90	1.20
9	.....	2.08	2.27	2.23	2.05	.....	24	2.04	2.08	2.10	2.33	1.90	1.20
10	2.04	.....	2.22	2.23	2.08	1.55	25	2.06	2.05	2.10	2.33	1.80	1.20
11	2.03	2.25	2.22	2.20	2.08	1.55	26	2.10	2.05	2.30	2.28	1.80	1.10
12	2.03	2.41	2.20	2.22	2.08	1.65	27	2.10	.....	2.30	2.20	1.80	1.10
13	2.01	2.53	2.18	2.22	2.08	1.65	28	2.09	2.04	2.30	2.20	1.80	.80
14	2.01	2.51	2.11	2.21	2.10	1.65	29	2.09	2.05	2.30	2.20	1.80	.80
15	2.00	2.48	2.10	2.20	2.13	1.60	30	2.09	2.02	2.30	2.20	1.80	.80
							31	2.09	.....	2.30	2.20	.....	.80

NOTE.—Water was turned out on days when gage was not read, and turned out for the season on October 31.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made on streams and canals in Yakima River drainage basin in 1907–8.

Miscellaneous measurements in Yakima River basin, Washington, in 1907–8.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
May 28, 1907	Yakima River	Columbia River	Easton, at abandoned station.	7.30	2,760
September 11, 1908	do	do	3½ miles below Prosser	[a] 3.56	[b] 741
Do	do	do	Gibbon, 7 miles below Prosser.	[a] 3.58	683
September 10, 1908	do	do	Chandler, 6½ miles above Kiona.	[a] 3.64	656
Do	do	do	3 miles above Kiona	[a] 3.68	608
May 29, 1907	Mosquito Creek	Yakima River	Highway crossing near Easton.		[c] 10
Do	Cabin Creek	do	One-half mile above mouth near Easton.	[d] −5.00	404
August 8, 1907	do	do	do		12
October 29, 1907	do	do	do		2.5
May 28, 1907	Silver Creek	do	Mouth near Easton		[c] 5
June 16, 1907	Fortune Creek	Clealum River	Mouth, Galena	[e] −5.75	65
Do	Camp Creek	do	do		15
Do	Boulder Creek	do	do		[c] 20
Do	Paris Creek	do	do		[c] 20
March 27, 1907	Roslyn Creek	Yakima River	Mouth, Clealum	[f] −13.75	10
May 1, 1907	do	do	do		9.1
May 30, 1907	do	do	do		2
May 3, 1908	Selah Creek	do	Above Pleasant Valley Irrigation Co.'s dam, Selah.		0
Do	do	do	7 miles below dam in canyon.		.3
June 21, 1907 [g]	Bumping River	Naches River	3 miles below Bumping Lake, near Nile.	3.75	840
August 29, 1907 [g]	do	do	do	1.80	73
August 30, 1907	American River	Bumping River	Near Nile	[h], [i] −4.65	62
August 31, 1907	Rattlesnake Creek	Naches River	Mouth near Nile	([i])	[c] 20
March 23, 1907	Oak Creek	Tieton River	Mouth near Naches		28
May 6, 1907	do	do	do	[j] −4.4	136
August 21, 1907	do	do	do	([i])	[c] 1.5
April 20, 1908	do	do	do	[j] −4.65	109
February 23, 1907	Tetherow Gulch	do	Road crossing sec. 19, T. 14 N., R. 17 E.		[k] 10
Do	Schuler Gulch	do	do		[k] 7.3
Do	Road Gulch	North Fork of Cowiche Creek.	Blair's homestead		[k] 7.2
February 24, 1907	do	do	do		[k] 30
Do	North Fork of Cowiche Creek.	do	Campbell ranch near Cowiche.	[l] 2.5	83
November 11, 1907	do	do	Cowiche	[m], [i] −3.12	.9
February 24, 1907	South Fork of Cowiche Creek.	Naches River	do	[n] 3.5	288
November 11, 1907	do	do	do	[o], [i] −3.03	2.6
August 26, 1907	Nasty Creek	Atanum Creek	Mouth, Tampico	([i])	[c] 1
May 1, 1908	do	do	do	([i])	[c] 5
June 3, 1907	Wide Hollow Waste.	Yakima River	Yakima city mill, Yakima.	[p] −2.45	71
August 15, 1907	South Fork of Atanum Creek.	Atanum Creek	4 miles above Tampico.	([q] [i])	16

[a] At Kiona.
[b] Discharge affected by removal of flashboards at dam at Prosser.
[c] Estimated.
[d] Below cut on east face of large cottonwood on left bank of west channel, 15 feet below bridge.
[e] Below cross cut in 12-inch balsam on left bank, 40 feet below highway bridge.
[f] Below top of hand rail downstream side of railroad bridge about 75 feet above mouth.
[g] At regular station established June 21, 1907, 3 miles below the outlet of Bumping Lake, to take the place of former station at dam site. No gage readings were obtained. The reference is a spike in a yellow-pine log overhanging the water on left bank, directly back of Tom Fife's cabin; elevation 10 feet above gage datum.
[h] Below an 8-penny nail in stream face of 2-foot cottonwood on right bank, 150 feet above Bumping Trail crossing.
[i] Low water.
[j] Below top of cottonwood stump, right side, just above bridge.
[k] Snow water from hills.
[l] Bench mark is top of floor of footbridge. Mark is on downstream side 4 feet from right bank; elevation 6.78 feet.
[m] Below 8-penny nail in alder stump, right bank, and 50 feet below highway crossing.
[n] Bench mark is spike in big cottonwood back of store.
[o] Below 8-penny nail in downstream pile of highway bridge abutment, right bank.
[p] Below top of first cross timber of flume of Yakima city mill.
[q] 200 feet above intake of upper Conrad ditch and above all diversions.

Miscellaneous measurements of canals in Yakima River drainage basin, Washington, in 1907–8.

Date.	Canal.	Diverts from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 6, 1907	Selah Moxee	Yakima River	Flume at Selah Gap		45
April 29, 1907	Union Gap	do	1,000 feet above highway bridge, Yakima.		5.7
June 4, 1907	do	do	do		8.3
September 12, 1908	Sunnyside	do	Prosser, above spillway	0.10	4.8
May 6, 1907	Selah Valley	Naches River	do	[a]—1.40	77
Do	Northwestern Light and Power Co.	do	Naches, above spillway	[b]—6.50	109
July 16, 1908	do	do	Naches		115
April 18, 1908	Yakima Valley or Congdon.	do	North Yakima	.92	24
Do	Naches-Cowiche	do	do	2.31	27
June 6, 1907	Parker	do	do		49
August 21, 1907	Power	do	2,000 feet below intake, North Yakima.	3.29	218
April 30, 1907	Power waste	do	North Yakima	[c]—5.70	77
August 21, 1907	Old Union	do	Gibson's ranch, North Yakima.	1.50	34
August 22, 1907	do	do	Above junction with power waste, North Yakima.		10
April 30, 1907	Old Union lateral	do	North Yakima	[d]—.30	6.6
June 6, 1907	New Union	do	Naches avenue, North Yakima.	2.53	45
August 22, 1907	do	do	do	2.51	37
April 30, 1907	Town	do	North Yakima	1.32	13
June 6, 1907	do	do	do	1.30	12

[a] Below top of center timber of bridge under floor, upstream side, at highway crossing one-fourth mile below head-gate.
[b] Below top of center timber of bridge under floor, downstream side, three-fourths mile below head-gate.
[c] Below top of guard rail, right end downstream side of bridge on Fourth street.
[d] Below bottom of bridge floor at highway crossing, opposite house of P. Stewart, Fruitvale.

EVAPORATION STATION AT LAKE KACHESS, WASH.

This station was established December 17, 1905, for the purpose of determining the evaporation from a water surface in this altitude. The records obtained here will doubtless be applicable to the other mountain lakes in this vicinity. The equipment consists of the usual evaporation pan with a sharp steel point in the center of the pan, the water surface being set at the level of the point at the time of each observation. Prior to June 11 the pan was anchored to a large rock in the middle of the lake about one-fourth mile above the outlet. On the latter date it was moved to a point near the outlet, where the water surface would not be subject to the wave action that interfered with the records at its former location. There is little difference in the atmospheric conditions at the two localities, and the records should be comparable.

Monthly precipitation and evaporation at Lake Kachess near Easton, Wash., for 1907 and 1908.

[H. G. Shandy, observer.]

Month.	Evaporation.	Precipitation.	Mean temperature—		
			Of water in pan.	Of water in lake.	Of atmosphere.
1907.	*Inches.*	*Inches.*			
June 11–30	0.65	.....	57°	55°	50°
July	4.42	0.16	65	63	69
August	3.36	0.82	67	66	67
September	1.60	1.21	61	59	55
October	1.90	0.03	56	54	54
The season	11.93	2.22	.....	.....	.....
1908.					
April	0.47	3.05	46	38	46
May	.55	2.31	44	45	53
June	1.99	1.34	50	50	67
July	3.38	1.80	64	63	84
August	3.92	.92	66	66	81
September	3.35	.46	61	61	75
October	1.55	3.83	52	52	57
November	1.08	3.11	48	48	45
December	.84	8.65	40	40	34
The period	17.13	25.47	52	52	60

EVAPORATION STATION AT ZILLAH, WASH.

During the seasons of 1907 and 1908 an evaporation pan has been maintained in the main Sunnyside canal at Zillah, Wash. This pan is of the usual pattern, observations being taken at intervals of two or three days and immediately after showers. The data obtained are believed to be as reliable as is possible with this method.

Monthly precipitation and evaporation at Zillah, Wash., for 1907 and 1908.

Month.	Evaporation.	Precipitation.	Mean temperature—	
			Of water in pan.	Of water in canal.
1907.	*Inches.*	*Inches.*		
July 2–31	3.48	0.00	70°	70°
August	4.15	.05	66	64
September	2.84	.04	64	64
October	1.85	.00	55	56
The season	12.32	.09	.....	.....
1908.				
April 25–30	1.22	.00	50	47
May	3.41	.63	55	51
June	4.68	.10	61	57
July	4.53	1.19	69	66
August	4.91	.04	66	65
September 1–19	2.02	.02	64	62
The period	20.77	1.98	61	58

SNAKE RIVER DRAINAGE BASIN.

DESCRIPTION.

Snake River, the largest tributary of the Columbia, rises among the high peaks of the Rocky Mountains in Yellowstone National Park, western Wyoming, and northeastern Idaho, heading in the divide from which streams flow northward and eastward into the Missouri and southward and westward to the Colorado and the lakes of the Great Basin. From Shoshone, Lewis, and Hart lakes, in Yellowstone National Park, the South Fork of the river flows southward, broadening into Jackson Lake (4 miles wide and 18 miles long) and passing through Jackson Valley (8 miles wide and 40 miles long), beyond which, near the Idaho-Wyoming line, it enters a long canyon. In the southern part of Fremont County, Idaho, it receives the North Fork. Below the junction of the Forks, the Snake flows westward across Idaho, to a point near Homedale, where it turns abruptly northward, forming for about 170 miles the boundary between Idaho and Oregon and for 30 miles more that between Idaho and Washington. At Lewiston, it crosses into Washington, flows northwest, west, and southwest, and joins the Columbia at Pasco Junction.

Practically all the large and most important tributaries of Snake River have their sources in the high mountains, which are heavily timbered. The heaviest timbered areas are those at the head of the South Fork in the Yellowstone Park region, the upper areas of the Teton, Fall, and North Fork of Snake rivers in southeastern Idaho, and those of upper Boise and Payette rivers in central Idaho.

Mean annual precipitation has a wide range throughout the Snake River drainage area. In the higher altitudes the precipitation is practically all in the form of snow, but the snowfall in the lower valleys below American Falls, Idaho, is comparatively light. During the past few years there has been considerable rainfall in this section and dry farming has been practiced successfully. In the valleys in the vicinity of Idaho Falls, Blackfoot, and St. Anthony, Idaho, the temperature ranges from 100° in the summer to 35° below zero in the winter; in the Twin Falls and Boise valleys the temperature ranges from approximately 110° in the summer to zero in the winter.

The driest year ever known in this drainage basin occurred in 1905. The wet years occurred in 1896, 1899, 1904, and 1907.

Snake River is noted for its many feasible storage sites, but only a very few have been developed. About 300,000 acre-feet can be stored at Jackson Lake by a temporary dam which has been installed by the United States Reclamation Service. The largest site is at Swan Valley on the South Fork of Snake, and the water available for

storage is approximately 4,000,000 acre-feet. Feasible reservoir sites are also found on the North Fork of Snake, Fall, Teton, Boise, and Payette rivers. Most of these sites will, no doubt, be used at some future date by the United States Reclamation Service in connection with the Minidoka, Dubois, and Payette-Boise irrigation projects.

Although irrigation has reached a high stage of development in the Snake River valley, approximately 6,000,000 acre-feet of water annually run to waste. Eventually thousands of acres of arid land will be irrigated by the storage of these flood waters.

The water-power possibilities are almost unlimited, but only a few sites have been developed owing to the lack of market for power in large quantities. Large power plants have been installed on Payette, Boise, and Snake rivers at American Falls, Shoshone Falls, and at the Minidoka dam, and many other smaller plants are also in use.

The upper drainage basin of the South Fork comprises the timbered, mountainous country west and southwest of Yellowstone Lake. The east side of its valley is bounded by the Wind River Range, from the slopes of which it receives a large number of tributaries, and the west side by the high Teton Mountains, from which most of the drainage flows westward through Teton River into North Fork.

Below the junction of North and South forks the Snake receives many tributaries, the most important of which are listed in the following table:

Principal tributaries of Snake River.

From the left (going downstream).	From the right (going downstream).
South Fork.	North (or Henry) Fork.
Willow Creek.	Teton River.
Blackfoot River.	Malade (or Big Wood) River.
Port Neuf River.	Boise River.
Raft River.	Payette River.
Goose Creek.	Weiser River.
Rock Creek.	Salmon River.
Salmon Falls River.	Clearwater River,
Bruneau River.	Palouse River.
Owyhee River.	
Malheur River.	
Alder Creek.	
Powder River.	
Imnaha River.	
Grande Ronde River.	

The following gaging stations have been maintained in this river basin (lists of stations on the other tributaries are given elsewhere):

South Fork of Snake River at Moran, Wyo. (1903–1908).
South Fork of Snake River near Lyon, Idaho (1903–1908).
North Fork of Snake River near Ora, Idaho (1902–1908).
Teton River near St. Anthony, Idaho (1903–1908).

Fall River at Fremont, Idaho (1904–1908).
Blackfoot River near Rossfork, Idaho (1908).
Blackfoot River near Presto, Idaho (1903–1908).
Snake River at Neeley, Idaho (1906–1908).
Snake River near Minidoka, Idaho (1895–1908).
Big Wood River near Shoshone, Idaho (1905–1908).
Boise River at Highland, Idaho (1895–1908). Replaces the Boise station.
Payette River at Horse Shoe Bend, Idaho (1906–1908).
North Fork of Payette River at Lardo, Idaho (1908).
Succor Creek near Homedale, Idaho (1903–1908).
Big Lost River near Chilly, Idaho (1904–1908).
Big Lost River near Mackay, Idaho (1903–1906).
Payette River at Payette, Idaho (1895–1897).
Big Wood River near Gimlet, Idaho (1904–1905).
Big Wood River at Toponis, Idaho (1896–1899).
Big Wood River at Bliss, Idaho (1899).
Little Wood River at Toponis, Idaho (1896–1899).
Little Wood River near Carey, Idaho (1904–1905).
Bruneau River at Grandview, Idaho (1895–1903).
Boise River at Caldwell, Idaho (1895–1896).
Little Camas Creek at Little Camas Store, Idaho (1896).
Port Neuf River at Pocatello, Idaho (1896–1899).
Weiser River at Weiser, Idaho (1895–1904).

SNAKE RIVER.

SNAKE RIVER NEAR BLACKFOOT, IDAHO.

This station is located at a wagon bridge 3½ miles north of Blackfoot, Idaho. Measurements were made during 1908 from the upstream side of the bridge. Measurements made during August, 1908, were affected by backwater and the gage readings bear no direct relation to the discharge, as during the period of these measurements a temporary diversion dam was being built across the river about 100 yards below.

Discharge measurements of Snake River near Blackfoot, Idaho, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 31	La Rue, Gay, Burridge, and Porter	394	1,520	5.12	3,460
August 1	G. T. Burridge	394	1,490	5.05	3,090
August 2	do	394	1,420	4.92	2,530
August 3	do	394	1.360	4.80	2,440
August 4	do	394	1.360	4.78	2,150
August 5	do	394	1,520	5.08	2,220
August 6	do	394	1.520	5.08	2,280
August 7	do	394	1,560	5.20	2,600
August 8	do	394	1,520	5.14	2,350
August 9	do	394	1,490	5.00	2,170
August 10	do	394	1.420	4.93	2,030
August 11	do	394	1,420	4.92	2,030
August 12	do	394	1,490	5.00	2,100

SNAKE RIVER AT NEELEY, IDAHO.

This station, which was established March 17, 1906, in order to obtain a record of the discharge of Snake River above the Minidoka and Twin Falls irrigation projects, is located at Bennion's ranch, one-half mile north of the Neeley post-office, Idaho, 4 miles west of American Falls, the nearest railway point, and 3 miles above the backwater from the Minidoka dam.

Port Neuf River joins the Snake about 5 miles above the station, and Raft River, which is very small, enters about 10 miles below.

Eighty-four canals, most of them in the vicinity of Blackfoot and Idaho Falls, Idaho, divert water from Snake River above this station. When these channels are diverting all the water in the river, and the channel is dry for a distance of 10 miles near Blackfoot, Idaho, a flow of about 2,000 second-feet is formed at the Neeley station. This water comes from springs in the river channel for a distance of 20 miles above the station.

The velocity of the current is rather low during all stages. The bed of the river at this point is permanent, being composed of solid rock. The gage heights are not affected by logging or artificial control above and seldom by ice. The gage datum has remained unchanged since the station was established.

A good rating curve has been obtained and the records may be considered very reliable.

Discharge measurements of Snake River at Neeley, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	A. D. Williams	527	5,410	8.90	21,500
May 28	do	532	6,310	10.60	31,200
June 8	do	532	6,310	10.58	31,400
June 27	do	522	6,130	10.30	30,000
July 10	do	530	6,170	10.35	29,400
July 19	do	519	5,410	8.90	22,200
July 30	La Rue and Williams	516	4,710	7.55	16,200
August 15	A. D. Williams	508	3,730	5.60	7,310
September 6	do	510	3,820	5.80	7,700
September 18	La Rue and Williams	508	3,570	5.30	5,990
October 11	A. D. Williams	509	3,670	5.50	7,070
1908.					
May 16	A. D. Williams	516	4,370	6.90	11,900
June 10	La Rue and Williams	524	5,340	8.80	21,100
July 15	Hoyt and La Rue	511	4,230	6.72	11,300
August 2	E. A. Porter	508	3,270	4.80	4,960
August 3	do	507	3,170	4.64	4,350
August 4	La Rue and Porter	506	3,160	4.58	4,120
August 5	E. A. Porter	506	3,110	4.48	4,020
August 6	do	507	3,130	4.50	3,980
August 7	do	507	3,130	4.50	4,040
August 8	do	506	3,160	4.58	4,140
August 9	do	507	3,130	4.50	4,010
August 11	do	505	3,060	4.40	3,840
August 12	do	505	3,030	4.35	3,680

Daily gage height, in feet, of Snake River at Neeley, Idaho, for 1907 and 1908.

[Alta Hunt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	5.0	5.8	7.6	9.3	10.1	7.2	6.0	5.4	5.8	5.7
2	.....	.....	5.0	5.8	7.6	9.6	10.1	7.0	6.0	5.4	5.8	5.7
3	.....	.....	5.1	5.8	7.7	10.0	10.1	7.0	5.9	5.4	5.8	5.7
4	.....	.....	5.1	5.9	7.6	10.0	10.1	6.9	5.8	5.5	5.8	5.6
5	.....	.....	5.2	6.0	7.7	10.1	10.1	6.9	5.8	5.5	5.8	5.5
6	.....	.....	5.3	6.1	7.7	10.1	10.3	6.9	5.7	5.6	5.8	5.6
7	.....	.....	5.3	6.2	7.9	10.4	10.4	6.8	5.7	5.5	5.8	5.7
8	.....	.....	5.2	6.2	8.0	10.7	10.5	6.7	5.8	5.5	5.7	5.7
9	.....	.....	5.2	6.2	8.1	11.0	10.5	6.5	5.9	5.5	5.7	5.7
10	.....	.....	5.1	6.3	8.1	11.1	10.4	6.4	5.8	5.5	5.7	5.7
11	.....	.....	5.1	7.2	8.4	11.2	10.3	6.3	5.6	5.5	5.7	5.7
12	.....	5.3	5.1	7.2	8.8	11.3	10.1	6.2	5.5	5.5	5.7	5.7
13	.....	5.3	5.0	7.2	9.1	11.1	9.9	6.0	5.5	5.6	5.6	5.7
14	.....	5.3	5.0	7.6	9.6	11.0	9.8	5.8	5.5	5.7	5.6	5.7
15	.....	5.3	5.0	7.7	9.4	11.1	9.6	5.6	5.5	5.9	5.7	5.7
16	.....	5.3	5.1	8.2	9.1	11.0	9.5	5.5	5.4	6.0	5.7	5.7
17	.....	5.3	5.1	8.2	8.9	10.9	9.4	5.4	5.3	5.9	5.7	5.7
18	.....	5.2	5.2	8.3	9.2	10.5	9.3	5.3	5.2	5.9	5.7	5.7
19	.....	5.2	5.4	8.6	9.6	10.1	8.9	5.2	5.2	5.9	5.7	5.7
20	.....	5.2	5.6	8.3	9.8	9.8	8.5	5.2	5.2	5.8	5.7	5.7
21	.....	5.2	5.9	8.0	10.2	9.9	8.4	5.1	5.2	5.8	5.7	5.7
22	.....	5.2	6.2	7.8	10.5	10.1	8.4	5.1	5.2	5.8	5.7	5.7
23	.....	5.2	6.5	7.6	10.7	10.3	8.4	5.0	5.2	5.8	5.7	5.7
24	.....	5.2	6.6	7.5	10.8	10.5	8.3	5.0	5.2	5.7	5.8	5.7
25	.....	5.1	6.5	7.5	10.8	10.5	8.2	5.1	5.2	5.7	5.8	5.7
26	.....	5.1	6.3	7.6	10.9	10.4	8.0	5.1	5.2	5.7	5.8	5.7
27	.....	5.0	6.2	7.6	10.8	10.3	7.9	5.3	5.3	5.7	5.8	5.7
28	.....	5.0	6.1	7.5	10.4	10.1	7.9	5.5	5.3	5.7	5.7	5.7
29	.....	.....	6.0	7.5	9.9	10.0	7.8	5.7	5.4	5.7	5.7	5.7
30	.....	.....	5.9	7.6	9.6	10.0	7.6	5.9	5.4	5.8	5.7	5.7
31	.....	.....	5.9	.....	9.4	.....	7.4	6.0	.....	5.8	.....	5.7
1908.[a]												
1	5.7	5.4	5.5	5.5	6.8	7.3	8.6	4.95	5.45	5.1	5.6	5.6
2	5.7	5.4	5.5	5.4	6.5	7.5	8.4	4.75	5.4	5.2	5.6	5.5
3	5.7	5.4	5.5	5.3	6.5	7.6	8.2	4.6	5.4	5.3	5.6	5.4
4	5.7	5.4	5.4	5.2	6.5	7.7	7.9	4.55	5.4	5.3	5.6	5.3
5	5.7	5.4	5.4	5.1	6.9	7.8	7.7	4.45	5.3	5.4	5.6	5.3
6	5.7	5.4	5.5	5.2	6.9	8.0	7.7	4.5	5.2	5.5	5.6	5.4
7	5.7	5.4	5.4	5.3	6.9	8.1	7.6	4.5	5.2	5.6	5.6	5.6
8	5.7	5.4	5.4	5.2	7.0	8.2	7.6	4.55	5.1	5.5	5.6	5.5
9	5.7	5.4	5.4	5.1	7.4	8.5	7.3	4.5	5.0	5.4	5.6	5.5
10	5.6	5.4	5.4	5.1	7.6	8.9	7.0	4.5	4.9	5.4	5.6	5.5
11	5.5	5.4	5.3	5.2	7.9	9.2	6.8	4.4	4.9	5.4	5.6	5.5
12	5.4	5.3	5.3	5.3	7.7	9.4	6.9	4.35	4.9	5.4	5.6	5.5
13	5.3	5.3	5.4	5.2	7.6	9.5	6.8	4.45	5.0	5.5	5.5	5.5
14	5.2	5.2	5.4	5.4	7.4	9.6	6.7	4.6	4.9	5.5	5.5	5.5
15	5.2	5.2	5.5	5.7	7.1	9.7	6.7	4.75	4.9	5.6	5.5	5.4
16	5.2	5.1	5.6	6.0	7.0	9.8	6.7	5.05	5.0	5.6	5.5	5.3
17	5.3	5.2	5.8	6.3	6.9	10.0	6.7	5.3	5.0	5.6	5.6	5.2
18	5.3	5.3	5.7	6.6	6.8	10.2	6.6	5.45	5.0	5.8	5.6	.....
19	5.3	5.3	5.9	6.8	6.8	10.4	6.6	5.7	5.0	6.0	5.6	.....
20	5.3	5.2	6.1	7.0	6.7	10.5	6.4	5.6	5.2	5.9	5.5	.....
21	5.3	5.1	6.0	7.1	6.6	10.6	6.2	5.65	5.1	5.8	5.5	.....
22	5.3	5.0	5.9	7.4	6.6	10.9	6.0	5.75	5.1	5.8	5.5	.....
23	5.3	5.0	5.7	7.7	6.5	10.4	5.9	5.7	5.2	5.8	5.5	.....
24	5.4	5.0	5.7	7.8	6.5	9.8	5.8	5.75	5.1	5.8	5.5	.....
25	5.4	5.2	5.6	7.8	6.5	9.7	5.6	5.7	5.1	5.7	5.4	.....
26	5.4	5.3	5.6	7.8	6.6	9.6	5.7	5.6	5.1	5.6	5.4	.....
27	5.4	5.5	5.5	7.6	6.6	9.4	5.6	5.6	5.1	5.6	5.4	.....
28	5.4	5.5	5.5	7.3	6.7	9.2	5.5	5.6	5.1	5.6	5.4	.....
29	5.4	5.5	5.5	7.0	6.8	9.0	5.3	5.6	5.1	5.6	5.4	.....
30	5.4	.....	5.5	6.9	6.9	8.8	5.2	5.6	5.1	5.6	5.4	.....
31	5.4	.....	5.5	.....	7.0	.....	5.1	5.6	.....	5.6	.....	.....

[a] Ice conditions January 11 to February 15 and December 18 to 27.

Rating table for Snake River at Neeley, Idaho, for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	2,140	4.90	5,050	6.20	9,590	8.00	17,520
3.70	2,310	5.00	5,320	6.30	10,010	8.20	18,480
3.80	2,490	5.10	5,600	6.40	10,430	8.40	19,460
3.90	2,680	5.20	5,890	6.50	10,860	8.60	20,460
4.00	2,880	5.30	6,190	6.60	11,290	8.80	21,460
4.10	3,090	5.40	6,510	6.70	11,720	9.00	22,500
4.20	3,310	5.50	6,850	6.80	12,160	9.20	23,540
4.30	3,540	5.60	7,210	6.90	12,600	9.40	24,600
4.40	3,780	5.70	7,590	7.00	13,040	9.60	25,680
4.50	4,020	5.80	7,970	7.20	13,920	9.80	26,780
4.60	4,270	5.90	8,370	7.40	14,800	10.00	27,900
4.70	4,520	6.00	8,770	7.60	15,700	11.00	33,600
4.80	4,780	6.10	9,180	7.80	16,600	12.00	39,400

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 24 discharge measurements made during 1907 and 1908, and is well defined between gage height 4.3 feet and 10.7 feet.

Monthly discharge of Snake River at Neeley, Idaho, for 1906 to 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.					
March 17–31	7,210	4,140	5,390	160,000	A.
April	12,600	5,460	7,580	451,000	A.
May	27,300	12,200	17,400	1,070,000	A.
June	27,900	10,900	21,800	1,300,000	A.
July	11,700	4,020	8,890	547,000	A.
August	5,180	2,220	3,020	186,000	B.
September	10,900	3,540	4,750	283,000	A.
October	5,050	4,270	4,690	288,000	A.
November	5,320	5,050	5,290	315,000	A.
December 1–5	5,320	5,320	5,320	52,800	A.
The period	.....	.....	.....	3,480,000	
1907.					
February 12–28	6,190	5,320	5,890	199,000	B.
March	11,300	5,320	7,120	438,000	A.
April	20,500	7,970	13,900	827,000	A.
May	33,000	15,700	23,600	1,450,000	A.
June	35,300	24,100	30,200	1,800,000	A.
July	30,700	14,800	23,900	1,470,000	A.
August	13,900	5,320	8,670	533,000	A.
September	8,770	5,890	6,890	410,000	A.
October	8,770	6,510	7,480	460,000	A.
November	7,970	7,210	7,700	458,000	A.
December	7,590	6,850	7,540	464,000	A.
The period	.....	.....	.....	8,510,000	
1908.					
January	7,590	5,890	6,710	413,000	B.
February	6,850	5,320	6,200	357,000	B.
March	9,180	6,190	7,100	437,000	A.
April	16,600	5,600	9,920	590,000	A.
May	17,100	10,900	12,700	781,000	A.
June	33,000	14,400	23,600	1,400,000	A.
July	20,500	5,600	11,800	726,000	A.
August	7,780	3,660	5,710	351,000	A.
September	6,680	5,050	5,640	336,000	A.
October	8,770	5,600	7,110	437,000	A.
November	7,210	6,510	6,960	414,000	A.
December [a]	7,210	.....	6,180	380,000	B.
The period	33,000	.....	9,140	6,620,000	

[a] Discharge estimated December 18 to 31.

SNAKE RIVER NEAR MINIDOKA, IDAHO.

This station was originally established August 3, 1895, at Montgomery's ferry, on the stage road from Minidoka to Albion, 4 miles east of Rupert, Idaho, and 10 miles below the diversion dam for the Minidoka irrigation project. Measurements at Montgomery's ferry show the amount of water available for irrigation there and for the newly constructed Twin Falls canals heading 23 miles below, and indicate also the conditions that will exist for power development at Shoshone Falls, about 45 miles below, after the irrigable lands of Snake River valley shall have been reclaimed.

The nearest tributary above the station is Raft River, which enters the Snake from the west about 18 miles above. No important tributaries enter below the station for a distance of 40 miles.

The low-water discharge at this station falls below 2,000 second-feet during the latter part of July and August in dry years. The Twin Falls irrigation canals divert about 25 miles below and their water right calls for 3,400 second-feet, while the Minidoka project (Pl. VII, *B*), which diverts 12 miles above the station, has a water right of 2,000 second-feet. The deficiency during low water is supplied by stored water from Jackson Lake, Wyoming.

The records are somewhat affected by ice during January and February, and some irregularity of flow is caused by the changing of gates at the Minidoka dam 12 miles above.

The gage datum has remained unchanged since August 28, 1905.

The records at this station are very good. The cross section is permanent and a good rating curve has been obtained.

Discharge measurements of Snake River near Minidoka, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. Sept. 3	A. D. Williams	832	4,520	3.75	7,300
1908. May 5	A. D. Williams	845	5,130	4.70	10,200

Daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1907 and 1908.

[George Montgomery, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]											
1		2.1	3.65	5.75	7.8	8.7	5.25	3.65	3.0	3.8	3.6
2		2.1	3.6	5.75	7.85	8.85	4.95	3.65	3.15	3.8	3.5
3		2.05	3.6	5.75	8.05	8.85	4.75	3.8	3.3	3.8	3.4
4		3.2	3.6	5.8	8.3	8.9	4.7	3.8	3.35	3.8	3.4
5		3.4	3.6	5.8	8.65	8.85	4.8	3.75	3.35	3.8	3.4
6		3.55	3.85	5.9	8.95	8.95	4.85	3.6	3.35	3.75	3.3
7		3.7	4.05	6.0	9.0	9.0	4.85	3.5	3.4	3.7	3.3
8		3.8	4.2	6.1	9.45	9.3	4.6	3.45	3.45	3.65	3.3
9		3.75	4.1	6.25	9.9	9.35	4.45	3.45	3.35	3.6	3.45
10		3.75	4.0	6.3	10.1	9.2	4.2	3.4	3.4	3.6	3.6

[a] December 19 to 24, backwater caused by ice.

Daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1907 and 1908—Con.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.											
11	.....	3.75	4.0	6.35	10.15	9.0	4.2	3.3	3.35	3.55	3.6
12	.....	3.75	4.25	6.8	10.35	8.8	4.05	3.2	3.3	3.55	3.75
13	.....	3.75	4.45	7.3	10.35	8.5	3.85	3.1	3.3	3.55	3.4
14	.....	3.7	4.85	7.7	10.2	8.4	3.55	3.0	3.45	3.45	3.75
15	.....	3.7	5.25	8.0	10.2	8.15	3.35	2.95	3.6	3.45	3.75
16	.....	3.6	5.7	7.85	10.2	8.05	3.15	2.85	3.75	3.5	3.7
17	1.95	3.6	6.15	7.6	10.05	8.0	2.9	2.7	3.8	3.45	3.6
18	2.0	3.5	6.85	7.5	9.7	7.7	2.7	2.8	3.8	3.5	3.85
19	2.0	2.75	7.2	7.7	9.3	7.4	2.95	2.75	3.8	3.6	5.1
20	2.0	2.15	7.1	8.1	8.9	6.9	2.75	2.8	3.7	3.6	4.85
21	2.0	2.0	6.7	8.6	8.65	6.75	2.7	2.9	3.65	3.6	5.0
22	2.0	2.0	5.7	9.05	8.7	6.6	2.65	3.0	3.6	3.6	5.1
23	2.0	2.1	5.8	9.3	8.9	6.6	2.55	3.0	3.6	3.55	4.4
24	2.0	2.2	5.85	9.7	9.15	6.55	2.5	3.0	3.6	3.7	4.05
25	2.0	2.15	5.75	9.7	9.45	6.5	2.4	2.95	3.6	3.6	3.75
26	2.05	2.2	5.8	9.7	9.45	6.3	2.55	2.85	3.65	3.6	3.6
27	2.05	3.3	5.8	9.7	9.15	6.1	2.65	3.0	3.65	3.55	3.6
28	2.1	3.85	5.8	9.5	9.0	5.95	3.0	3.0	3.5	3.55	3.65
29	.....	4.0	5.7	9.3	8.85	5.85	3.2	3.15	3.6	3.55	3.7
30	.....	4.0	5.7	8.55	8.8	5.75	3.5	3.1	3.6	3.6	3.7
31	.....	4.0	.....	8.2	.....	5.5	3.6	.....	3.7	.....	3.65

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	3.7	4.3	3.6	3.05	4.75	5.15	7.35	2.25	3.3	2.9	3.65	3.25
2	3.7	4.7	3.6	3.1	4.5	5.45	6.85	2.05	3.25	2.9	3.65	3.05
3	3.35	4.1	3.5	3.1	4.35	5.75	6.6	1.85	3.15	3.05	3.65	2.95
4	3.3	3.55	3.4	3.1	4.3	5.95	6.35	1.65	3.2	3.25	3.6	3.2
5	3.3	3.15	3.4	3.1	4.75	6.15	6.1	1.55	3.2	3.0	3.65	3.25
6	3.25	2.85	3.5	3.1	4.95	6.3	5.85	1.5	3.15	3.1	3.65	3.3
7	3.25	2.65	3.5	3.1	5.1	6.4	5.7	1.35	3.1	3.1	3.5	3.4
8	3.25	2.85	3.35	3.1	4.95	6.5	5.75	1.35	3.1	3.1	3.55	3.4
9	3.3	3.05	3.3	3.1	5.4	6.9	5.35	1.4	2.95	3.1	3.6	3.35
10	3.25	3.2	3.2	3.1	5.65	7.2	5.05	1.3	2.8	3.1	3.65	3.3
11	3.05	3.2	3.2	2.65	5.85	7.35	4.85	1.2	2.75	3.1	3.4	3.4
12	2.95	3.2	3.35	1.85	6.05	7.55	4.65	1.1	2.75	3.1	3.15	3.4
13	3.0	3.2	3.55	1.8	5.85	7.8	4.55	1.2	2.7	3.1	3.4	3.3
14	2.9	3.1	3.75	1.85	5.65	7.8	4.6	1.2	2.7	3.1	3.5	3.3
15	2.95	3.0	3.8	1.85	5.2	8.0	4.45	1.5	2.7	3.25	3.45	3.25
16	3.1	3.0	3.8	1.9	4.85	8.25	4.4	1.95	2.7	3.5	3.4	3.3
17	2.95	2.95	3.75	3.05	4.8	8.35	4.3	2.3	2.7	3.6	3.3	3.5
8	2.9	2.95	3.95	4.1	4.7	8.7	4.15	2.8	2.8	3.75	3.25	4.3
19	3.05	3.0	4.15	4.65	4.65	8.95	4.05	3.1	2.8	3.9	3.25	4.9
20	3.1	3.0	4.2	4.85	4.8	9.2	3.85	3.4	2.8	4.05	3.25	5.0
21	3.1	3.0	4.2	5.05	4.75	9.45	3.65	3.5	2.9	4.2	3.25	4.9
22	3.1	3.0	4.3	5.25	4.55	9.3	3.55	3.6	2.95	4.15	3.3	4.55
23	3.3	2.9	4.25	5.4	4.5	9.2	3.4	3.6	3.0	3.85	3.5	3.4
24	3.15	2.9	4.05	5.65	4.3	8.7	3.25	3.7	3.0	3.7	3.5	3.45
25	3.2	3.0	4.15	5.95	4.15	8.15	3.15	3.6	3.0	3.7	3.5	3.6
26	3.15	3.1	4.2	5.8	4.25	7.75	2.95	3.7	3.0	3.65	3.5	3.45
27	3.05	3.25	4.15	5.35	4.45	7.55	2.8	3.7	2.85	3.65	3.3	3.3
28	3.1	3.55	4.1	5.15	4.65	7.5	2.75	3.55	2.8	3.6	3.3	3.2
29	3.15	3.6	4.1	5.0	4.8	7.55	2.55	3.55	2.85	3.65	3.3	3.2
30	3.3	.....	4.1	4.9	5.1	7.6	2.55	3.55	2.9	3.65	3.3	3.1
31	3.6	.....	3.4	.....	5.05	.....	2.35	3.4	.....	3.65	.....	3.05

[a] January 10 to February 3, slight ice conditions. March 12 to October 15, gage heights affected by opening and closing of gates at Minidoka dam. December 16 to 26, ice conditions.

Rating table for Snake River near Minidoka, Idaho, for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	1,880	2.60	4,680	4.10	8,790	6.20	15,830
1.20	1,960	2.70	4,930	4.20	9,080	6.40	16,550
1.30	2,060	2.80	5,180	4.30	9,380	6.60	17,270
1.40	2,190	2.90	5,440	4.40	9,680	6.80	18,010
1.50	2,340	3.00	5,700	4.50	9,980	7.00	18,790
1.60	2,500	3.10	5,970	4.60	10,280	7.20	19,610
1.70	2,670	3.20	6,240	4.70	10,580	7.40	20,450
1.80	2,860	3.30	6,510	4.80	10,890	7.60	21,290
1.90	3,060	3.40	6,780	4.90	11,210	7.80	22,130
2.00	3,270	3.50	7,060	5.00	11,540	8.00	23,010
2.10	3,480	3.60	7,340	5.20	12,230	9.00	27,650
2.20	3,700	3.70	7,630	5.40	12,950	10.00	32,950
2.30	3,940	3.80	7,920	5.60	13,670	11.00	38,800
2.40	4,180	3.90	8,210	5.80	14,390		
2.50	4,430	4.00	8,500	6.00	15,110		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1905–1907, and is well defined above gage height 2.3 feet. Below gage height 5.5 feet it is the same as the 1906 table.

Monthly discharge of Snake River near Minidoka, Idaho, for 1907 and 1908.

[Drainage area, 17,900 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 17–28	3,480	3,160	3,300	0.184	0.08	78,500	A.
March	8,500	3,380	6,180	.345	.40	380,000	A.
April	19,600	7,340	12,100	.676	.75	720,000	A.
May	31,300	14,200	21,800	1.22	1.41	1,340,000	A.
June	35,000	22,100	29,100	1.63	1.82	1,730,000	A.
July	29,400	13,300	22,100	1.23	1.42	1,360,000	A.
August	12,400	4,180	7,500	.419	.48	461,000	A.
September	7,920	4,930	6,200	.346	.39	369,000	A.
October	7,920	5,700	7,090	.396	.46	436,000	A.
November	7,920	6,920	7,380	.412	.46	439,000	A.
December	18,100	6,510	7,340	.410	.47	451,000	A.
The period						7,760,000	
1908.							
January	7,630	5,440	6,200	.346	.40	381,000	B.
February	7,340	5,440	6,060	.339	.37	349,000	B.
March	9,380	6,240	7,840	.438	.50	482,000	A.
April	14,900	2,860	8,100	.453	.51	482,000	A.
May	15,300	8,940	11,300	.631	.73	695,000	A.
June	30,000	12,100	21,400	1.20	1.34	1,270,000	A.
July	20,200	4,060	10,100	.564	.65	621,000	A.
August	7,630	1,880	4,560	.255	.29	280,000	A.
September	6,510	4,930	5,520	.308	.34	328,000	A.
October	9,080	5,440	6,900	.385	.44	424,000	A.
November	7,480	6,100	6,900	.385	.43	411,000	A.
December	6,780	5,570	6,420	.359	.41	395,000	A.
The year	30,000	1,880	8,440	.472	6.41	6,120,000	

NOTE.—Discharges have been computed, using the 1906 rating for medium and low stages. The two measurements made in 1907 and 1908 plot about 5 per cent smaller than this curve, but the channel is believed to be permanent. These values are subject to revision should further data confirm the later measurements.

SOUTH FORK OF SNAKE RIVER BASIN.

JACKSON LAKE NEAR MORAN, WYO.

Jackson Lake is situated just east of the Idaho-Wyoming state line, a short distance south of the Yellowstone National Park. It is drained by the South Fork of Snake River. Its storage possibilities have been developed by the construction of a dam near the lake outlet.

Daily gage height, in feet, of Jackson Lake near Moran, Wyo., for 1908.

Day.	July.	Aug.	Day.	July.	Aug.	Day.	July.	Aug.	Day.	July.	Aug.
1	7.1	9.8	9	9.0	8.35	17	9.6	6.35	25	9.7	4.8
2	7.35	9.75	10	9.15	8.15	18	9.6	6.08	26	9.7	4.7
3	7.55	9.55	11	9.3	7.95	19	9.5	5.85	27	9.75	4.55
4	7.85	9.35	12	9.4	7.7	20	9.5	5.62	28	9.8	4.4
5	8.2	9.14	13	9.5	7.42	21	9.5	5.35	29	9.8	4.3
6	8.5	8.95	14	9.6	7.12	22	9.6	5.2	30	9.8	4.1
7	8.65	8.74	15	9.6	6.9	23	9.65	5.08	31	9.8	4.0
8	8.8	8.55	16	9.6	6.65	24	9.65	4.95			

SOUTH FORK OF SNAKE RIVER AT MORAN, WYO.

This station, which was established September 21, 1903, to determine the amount of water available in Jackson Lake, is located directly back of the post-office at Moran, Wyo., and about three-fourths of a mile below the outlet of Jackson Lake.

There are no diversions above the station, which lies between Pacific Creek and the outlet of the lake, and the record covers only the water that flows from the lake.

The records are not affected by logging or ice conditions, but a temporary dam has been installed at the lake by the United States Reclamation Service and the daily flow at the station is affected by the raising and lowering of the gates at the dam. The annual run-off, however, is not affected.

The gage datum has remained unchanged since the station was established.

As the cross section is permanent a very good rating curve has been obtained and the records may be considered very reliable.

Discharge measurements of South Fork of Snake River at Moran, Wyo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 19	A. D. Williams	209	1,320	5.80	6,020
June 20	Williams and Mahoney	209	1,330	5.85	5,980
July 11	S. C. Mahoney	209	1,450	6.40	7,020
July 28	do	209	1,060	4.50	3,870
August 8	do	206	878	3.65	2,880
August 20	do	206	705	2.80	1,830
August 29	do	206	669	2.55	1,560
1908.					
June 21	Gay and Mahoney	212	1,330	5.85	5,920

Daily gage height, in feet, of South Fork of Snake River at Moran, Wyo., for 1907 and 1908.

[Mrs. Maria Allen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1			1.45	1.75				4.2	2.55		1.85	1.35
2					2.05	5.2						
3			1.45				6.2	4.0			1.85	
4				1.75					2.35			1.35
5							6.3					
6			1.4		2.25	6.0		3.9			1.8	
7												
8			1.4	1.7		6.5		3.65	2.2			1.4
9							6.5	3.65				
10			1.35								1.75	
11				1.85	2.7		6.4		2.15	2.75		1.4
12								3.4		2.75		
13			1.3			6.6				2.65	1.6	
14					3.1					2.55		
15			1.3	1.9				3.25				1.35
16						6.25	5.7					
17		1.6	1.3		3.5		5.5				1.5	
18				2.1				3.05		2.35		1.35
19			1.5			5.8						
20		1.55				5.85		2.8		2.2	1.45	
21					4.25		5.05					
22		1.5	1.7	2.05								1.35
23							4.9			2.1		
24		1.5	1.75			6.3					1.45	
25				2.0				2.7				1.35
26					4.9							
27		1.45	1.8							2.0	1.45	
28					4.8		4.5					
29			1.8	2.0		6.25		2.55				1.4
30					4.9		4.25			1.9		
31			1.75									
1908.[b]												
1	1.45		1.3	1.4	2.45		4.95	2.7	2.45	1.65	1.45	1.35
2	1.5	1.35				3.7	3.4	4.35	2.45			
3				1.35	2.6	3.75	3.1	4.25		1.65	1.4	1.35
4	1.45		1.3				3.1	4.4	2.4	1.6		
5	1.4	1.35		1.35	2.65	3.8	3.15	4.35		1.6	1.4	1.35
6					2.7		3.3	4.35	2.3			
7	1.45				2.85	3.9	3.35	4.25	2.3	1.6	1.4	1.35
8	1.45		1.3	1.4		4.0	3.45	4.25	2.25			
9		1.35			3.4		3.5	4.2			1.4	1.35
10	1.5			1.4	3.7	4.35	3.6	4.3	2.25	1.55		
11	1.5		1.3					4.3		1.55		
12	1.5	1.35		1.45	3.8	4.55	3.65	4.35	2.0		1.4	1.35
13					3.8		3.75	5.15	2.0			
14				1.5		5.15		4.8		1.5	1.4	1.35
15	1.45		1.35	1.5		5.35	4.0	4.8	2.0			
16		1.35				5.65		4.5		1.5	1.4	
17			1.35		3.7	5.85	4.1	4.65	2.0			1.35
18			1.4		3.65	6.0		4.45		1.5	1.4	
19	1.4	1.3		1.6		6.0	3.9	4.45	1.95			1.35
20			1.4	1.75	3.5	6.0	3.35	3.9				
21				1.9		5.95		3.7	1.8	1.55	1.4	1.3
22	1.4		1.45	2.0		5.75	3.1	3.6				
23		1.25		2.05		5.55	2.0	3.5	1.85		1.4	1.3
24			1.45	2.15	3.45	5.45		3.45		1.6		
25			1.45	2.25			2.7		1.7	1.6		
26	1.35	1.25		2.3				3.15	1.7		1.4	1.3
27			1.4		3.5		2.8			1.5		
28				2.35		5.35	2.8	2.9	1.7		1.35	1.3
29	1.35		1.4	2.4	3.55	5.25	2.8	2.65		1.45		
30						4.0	2.75	2.5	1.7			
31			1.4		3.6		2.75	2.45		1.45		1.3

[a] Gates at dam closed from September 15 to October 10.
[b] Headgates closed at Jacksons Lake July 19, and opened again August 2.

Rating table for South Fork of Snake River at Moran, Wyo., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	330	2.10	1,163	3.40	2,400	5.40	5,260
.90	374	2.20	1,244	3.50	2,515	5.60	5,600
1.00	422	2.30	1,327	3.60	2,635	5.80	5,940
1.10	474	2.40	1,412	3.70	2,760	6.00	6,300
1.20	530	2.50	1,499	3.80	2,885	6.20	6,660
1.30	590	2.60	1,588	3.90	3,010	6.40	7,020
1.40	653	2.70	1,679	4.00	3,140	6.60	7,380
1.50	719	2.80	1,772	4.20	3,420	6.80	7,760
1.60	788	2.90	1,868	4.40	3,710	7.00	8,140
1.70	859	3.00	1,967	4.60	4,010	8.00	10,900
1.80	932	3.10	2,070	4.80	4,310		
1.90	1,007	3.20	2,175	5.00	4,620		
2.00	1,084	3.30	2,285	5.20	4,940		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 17 discharge measurements made during 1903–1908, and is well defined between gage heights 1.25 feet and 6.4 feet.

Monthly discharge of South Fork of Snake River at Moran, Wyo., for 1907 and 1908.

[Drainage area, 820 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 16–28	788	686	738	0.900	0.44	19,000	A.
March	932	590	734	.895	1.03	45,100	A.
April	1,160	859	1,010	1.23	1.37	60,100	A.
May	4,620	1,080	2,650	3.23	3.72	163,000	A.
June	7,380	4,780	6,480	7.90	8.81	386,000	A.
July	7,200	3,420	5,560	6.78	7.82	342,000	A.
August	3,420	1,540	2,250	2.74	3.16	138,000	A.
September	1,540	0	610	.744	.83	36,300	A.
October	1,730	0	874	1.07	1.23	53,700	A.
November	970	686	793	.967	1.08	47,200	A.
December	686	622	637	.777	.90	39,200	A.
The period						1,330,000	
1908.							
January	719	622	669	.816	.94	41,100	A.
February	622	560	602	.734	.79	34,600	A.
March	686	590	627	.765	.88	38,600	A.
April	1,410	622	878	1.07	1.19	52,200	A.
May	2,880	1,460	2,380	2.90	3.34	146,000	A.
June	6,300	2,700	4,500	5.49	6.12	268,000	A.
July	4,540	1,080	2,370	2.89	3.33	146,000	A.
August	4,860	1,460	3,100	3.78	4.36	191,000	A.
September	1,460	859	1,110	1.35	1.51	66,000	A.
October	824	686	753	.918	1.06	46,300	A.
November	686	622	651	.794	.89	38,700	A.
December	622	590	610	.744	.86	37,500	A.
The year	6,300	560	1,520	1.85	25.27	1,110,000	

NOTE.—Discharges interpolated on days when gage was not read.

SOUTH FORK OF SNAKE RIVER NEAR LYON, IDAHO.

This station, which was established April 18, 1903, in order to determine the water available for storage at the Swan Valley reservoir site, 2 miles above, is located on the old site of Wedekind's ferry, between Lyon and Swan Valley, at the upper end of Conant Valley.

No tributaries enter below this station, and the records therefore show the run-off for the entire drainage basin of the South Fork of Snake River. The main tributaries above are Salt, John Day, Hobacks, Gros Ventre, and Buffalo rivers.

No water is diverted above the station except for a few shoestring ranches along the river.

The gage heights are not affected by logging operations, but are affected by ice during the winter months, and the daily flow shows somewhat the effect of the raising and lowering of the gates at the Jackson Lake reservoir above.

A new gage was set October 16, 1904, about 1 mile above the gage first installed, and the gage datum has remained unchanged since that time.

The cross section is permanent and a good rating has been obtained. The records may be considered very reliable.

Discharge measurements of South Fork of Snake River near Lyon, Idaho, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 17	La Rue and Williams	308	2,940	7.80	26,500
August 1	A. D. Williams	278	1,860	3.75	8,340
August 2	do	278	1,860	3.75	8,310
August 3	do	280	1,900	3.90	8,700
August 4	do	282	1,940	4.25	9,240
August 5	do	282	1,940	4.25	9,220
August 6	do	280	1,930	4.20	9,170
August 7	do	280	1,910	4.10	9,040
August 8	do	280	1,900	4.00	8,920
August 9	do	279	1,890	3.90	8,630
August 10	do	279	1,890	3.90	8,500
August 11	do	280	1,910	4.10	9,100
August 12	do	280	1,910	4.10	9,100

Daily gage height, in feet, of South Fork of Snake River near Lyon, Idaho, for 1907 and 1908.

[Richard Later and Garfield Smith, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	1.1	1.95	4.15	7.5	8.1	6.3	.....	2.8	2.5	.....
2	.....	.....	1.1	2.1	4.25	7.6	8.4	6.25	.....	2.85	2.5	1.7
3	.....	.....	1.1	2.2	4.5	7.7	8.55	.....	.....	2.9	.....	1.7
4	.....	.....	1.15	2.3	4.6	8.0	8.6	.....	.....	2.9	2.2	1.7
5	.....	.....	1.1	2.2	4.75	8.2	8.75	6.2	.....	2.9	2.2	1.7
6	.....	.....	1.25	2.1	4.9	8.6	8.8	6.15	.....	2.9	2.2	1.8
7	.....	.....	1.2	2.3	5.1	8.2	.....	6.1	.....	2.9	2.2	1.8
8	.....	.....	1.2	2.55	5.2	8.3	8.7	6.05	.....	2.85	2.1	.....
9	.....	.....	1.15	2.7	5.5	8.35	8.6	5.95	.....	2.75	2.1	1.7
10	.....	.....	1.15	3.2	6.0	8.4	8.4	5.9	.....	2.7	.....	1.6
11	.....	.....	1.15	4.0	6.3	8.2	8.2	.....	.....	2.7	2.05	1.7
12	.....	.....	1.15	4.3	6.3	8.2	8.1	5.85	.....	2.7	2.0	1.7
13	.....	.....	1.15	4.4	6.3	8.6	8.0	5.65	.....	.....	2.0	1.75
14	.....	.....	1.15	4.9	5.9	8.5	.....	5.5	.....	2.75	1.95	1.75
15	.....	.....	1.1	5.35	5.65	8.0	7.7	5.35	.....	2.7	1.95	.....
16	.....	.....	1.1	5.85	6.3	7.6	7.45	5.2	.....	2.75	1.9	1.6
17	.....	.....	1.3	5.5	6.95	7.15	6.85	5.1	.....	2.75	.....	1.55
18	.....	.....	1.65	5.1	7.3	7.5	6.55	(a)	.....	2.75	1.9	1.6
19	.....	.....	2.1	4.6	7.7	8.1	6.5	.....	.....	2.7	1.85	1.6
20	.....	1.15	2.65	4.2	8.1	8.25	6.4	.....	2.3	.....	1.85	(b)

a No record from August 18 to October 1. b River raised by an ice gorge from December 20 to 31.

Daily gage height, in feet, of South Fork of Snake River near Lyon, Idaho, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	.....	1.15	2.2	4.1	8.3	8.45	.....	.....	.....	2.7	1.85	.....
22	.....	1.15	2.95	3.95	8.1	8.85	6.4	.....	.....	2.7	1.8	.....
23	.....	1.20	2.55	4.0	8.3	8.2	6.35	.....	.....	2.65	1.8	.....
24	.....	1.15	2.45	4.05	8.5	7.6	6.5	.....	.....	2.65	.....	.....
25	.....	1.15	2.4	3.95	8.35	7.5	6.45	.....	.....	2.6	1.8	.....
26	.....	1.2	2.25	3.95	7.75	7.5	6.35	.....	.....	2.6	1.75	.....
27	.....	1.1	2.1	4.1	7.2	7.3	6.3	.....	.....	.....	1.75	.....
28	.....	1.1	2.05	4.15	7.1	7.4	.....	.....	.....	2.6	1.75	.....
29	.....	.....	2.0	4.2	7.15	7.8	6.35	.....	.....	2.55	1.75	.....
30	.....	.....	1.95	4.3	7.0	8.0	6.3	.....	.....	2.55	1.7	.....
31	.....	.....	1.95	.....	7.0	.....	6.25	.....	.....	2.5	.....	.....
1908 [a]												
1	.....	9.5	3.1	1.5	3.7	5.0	7.4	3.7	2.75	1.95	1.7	1.05
2	.....	.....	3.1	1.5	3.75	5.05	7.0	3.75	2.7	1.9	1.7	1.05
3	.....	9.5	3.1	1.5	3.75	5.05	6.4	3.75	2.6	2.05	1.65	1.05
4	.....	9.5	3.1	1.5	3.75	5.05	6.45	4.25	2.5	2.05	1.65	1.05
5	.....	9.5	3.1	1.5	3.65	5.1	6.5	4.25	2.45	1.95	1.65	1.0
6	.....	9.5	3.1	1.55	3.6	5.2	6.45	4.2	2.4	1.95	1.65	.....
7	.....	9.5	3.1	1.55	3.7	5.3	6.4	4.1	2.35	1.9	1.65	.....
8	.....	9.5	2.15	1.65	3.75	5.35	6.3	4.0	2.35	1.9	1.6	.....
9	.....	.....	1.25	1.7	3.8	5.75	6.25	3.9	2.3	1.85	1.6	.....
10	.....	9.5	1.15	1.8	3.8	6.0	6.2	3.9	2.3	1.85	1.6	.....
11	.....	9.5	1.1	1.85	3.85	6.3	6.1	4.1	2.3	1.85	.....	.....
12	.....	9.5	1.05	2.35	3.9	6.55	6.05	4.05	2.25	1.8	1.45	.....
13	9.5	9.5	.95	2.85	3.95	6.85	6.0	4.3	2.35	1.8	1.45	.....
14	9.5	9.5	.95	3.05	4.0	7.0	5.95	4.35	2.3	1.8	1.3	.....
15	9.5	9.5	1.05	3.35	4.05	7.2	6.0	4.3	2.25	2.0	1.3	.....
16	9.5	.....	1.15	3.8	4.15	7.5	5.9	4.3	2.25	2.05	.....	.....
17	9.5	9.5	1.25	3.95	4.3	7.8	5.7	4.1	2.2	2.0	.....	.....
18	9.5	9.5	1.65	3.85	4.45	7.7	5.6	4.0	2.2	1.9	.....	.....
19	.....	9.5	1.75	4.0	4.35	7.3	5.5	4.1	2.15	1.9	.....	.....
20	9.5	9.5	1.65	4.15	4.35	7.15	5.4	3.95	2.1	1.9	.....	.....
21	9.5	9.5	1.5	4.3	4.35	7.0	5.3	3.8	2.1	1.85	.....	.....
22	9.5	9.5	1.55	4.6	4.3	6.7	5.2	3.7	2.05	1.8	.....	.....
23	9.5	.....	1.65	4.7	4.3	6.55	5.1	3.6	2.0	1.8	.....	.....
24	9.5	9.5	1.65	4.5	4.3	6.35	5.05	3.5	2.0	1.75	.....	.....
25	9.5	9.5	1.65	4.0	4.3	6.4	5.0	3.4	2.0	1.75	.....	.....
26	.....	9.5	1.65	3.7	4.35	6.6	5.05	3.2	2.0	1.75	.....	.....
27	9.5	9.5	1.65	3.35	4.35	6.75	5.1	3.1	2.0	1.7	.....	.....
28	9.5	9.5	1.65	3.25	4.35	6.8	5.1	3.0	1.95	1.7	1.2	.....
29	9.5	9.5	1.55	3.25	4.4	6.8	4.55	2.9	1.95	1.7	1.2	.....
30	9.5	.....	1.5	3.3	4.45	6.7	4.0	2.8	1.95	1.7	1.2	.....
31	9.5	.....	1.4	.....	4.7	.....	4.0	2.8	.....	1.7	.....	.....

[a] The river was gorged with ice from December 20, 1907, to February 29, 1908; the channel was probably clear about March 9. River frozen November 16 to 27 and December 8 to 21. December 6 and 7 the water was below gage.

Rating table for South Fork of Snake River near Lyon, Idaho, for 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	2,460	2.30	4,465	3.50	7,280	5.40	14,160
1.20	2,585	2.40	4,670	3.60	7,560	5.60	15,010
1.30	2,715	2.50	4,880	3.70	7,850	5.80	15,900
1.40	2,855	2.60	5,090	3.80	8,150	6.00	16,830
1.50	3,000	2.70	5,310	3.90	8,450	6.20	17,790
1.60	3,155	2.80	5,530	4.00	8,760	6.40	18,760
1.70	3,320	2.90	5,750	4.20	9,420	6.60	19,750
1.80	3,495	3.00	5,980	4.40	10,150	6.80	20,750
1.90	3,680	3.10	6,220	4.60	10,920	7.00	21,760
2.00	3,870	3.20	6,470	4.80	11,710	8.00	27,060
2.10	4,065	3.30	6,730	5.00	12,520	9.00	32,770
2.20	4,265	3.40	7,000	5.20	13,340		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 23 discharge measurements made during 1905–1908 and is well defined between gage heights 0.9 foot and 7.8 feet.

Monthly discharge of South Fork of Snake River near Lyon, Idaho, for 1907 and 1908.

[Drainage area, 5,480 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 20–28	2,580	2,460	2,520	0.460	0.15	45,000	B.
March	5,860	2,460	3,350	.611	.70	206,000	A.
April	16,100	3,780	8,500	1.55	1.73	506,000	A.
May	29,900	9,250	19,500	3.56	4.10	1,200,000	A.
June	31,900	22,500	27,000	4.93	5.50	1,610,000	A.
July	31,600	18,000	24,000	4.38	5.05	1,480,000	A.
August 1–17	18,300	12,900	16,300	2.97	1.88	550,000	A.
October	5,750	4,880	5,360	.978	1.13	330,000	A.
November	4,880	3,320	3,850	.703	.78	229,000	A.
December [a]	3,500	3,080	3,250	.593	.68	200,000	B.
The period						6,360,000	
1908.							
January [b]			3,020	.551	.64	186,000	C.
February			2,790	.509	.55	160,000	C.
March			2,920	.533	.61	180,000	B.
April	11,300	3,000	6,230	1.14	1.27	371,000	A.
May	11,300	7,560	9,110	1.66	1.91	560,000	A.
June	26,000	12,000	18,800	3.43	3.83	1,120,000	A.
July	23,800	8,760	15,700	2.86	3.30	965,000	A.
August	9,960	5,530	8,170	1.49	1.72	502,000	A.
September	5,420	3,780	4,340	.792	.88	258,000	A.
October	3,970	3,320	3,610	.659	.76	222,000	A.
November [c]	3,320	2,580	2,880	.526	.59	171,000	A.
December [d]			2,430	.444	.51	149,000	C.
The year	26,000		6,670	1.22	16.57	4,840,000	

[a] Discharge estimated for December 20 to 31 because of ice conditions.
[b] Discharge from January 1 to March 8 estimated to be 45 per cent of discharge at Neeley station for same period.
[c] Discharge interpolated for November 16 to 27 because of ice conditions.
[d] Discharge from December 6 to 31 estimated to be 40 per cent of discharge at Neeley for same period.

NORTH FORK OF SNAKE RIVER BASIN.

NORTH FORK OF SNAKE RIVER NEAR ORA, IDAHO.

The North Fork of Snake River rises in Lake Henry and flows south and southwest to its junction with South Fork.

The gaging station, which was established August 20, 1902, to determine the amount of water available for storage purposes above, after deducting the amount already appropriated for irrigation, is located at North Fork Bridge, 2 miles south of Ora and 10 miles above, St. Anthony, Idaho.

Teton and Fall rivers enter below the gaging station, the Teton coming in about 3 miles above the junction of the North Fork with the South Fork of Snake River. Above the gaging station the principal tributaries are Robinsons Creek and Warm River. No water is diverted for irrigation above the station. The river is subject to no artificial control above and is too shallow for logging.

The gage datum has remained unchanged since the station was established.

The records are fair during high water and good during low water, some inaccuracy being due to changes in the channel. Gage heights are affected only slightly by ice conditions.

Discharge measurements of North Fork of Snake River near Ora, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 23	A. D. Williams	174	631	3.2	3,030
June 13	do	176	553	3.0	2,590
July 6	do	176	475	2.6	1,730
July 20	do	176	440	2.4	1,630
August 21	do	177	397	2.3	1,190
1908.					
May 19	A. D. Williams	178	448	2.65	1,880

Daily gage height, in feet, of North Fork of Snake River near Ora, Idaho, for 1907 and 1908.

[Martha J. Fritz, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	2.0	2.1	2.9	2.9	2.8	2.4	2.3	2.3	2.3	2.2
2	.....	.....	2.0	2.1	2.9	2.9	2.7	2.4	2.3	2.3	2.3	2.2
3	.....	.....	2.0	2.1	3.0	2.9	2.7	2.4	2.3	2.3	2.3	2.2
4	.....	.....	2.0	2.3	3.1	2.9	2.7	2.4	2.3	2.3	2.3	2.2
5	.....	.....	2.0	2.4	3.1	2.9	2.7	2.4	2.3	2.3	2.3	2.2
6	.....	.....	2.0	2.4	3.1	2.9	2.6	2.4	2.3	2.3	2.3	2.2
7	.....	.....	2.0	2.4	3.1	3.0	2.6	2.4	2.3	2.3	2.3	2.2
8	.....	2.0	2.0	2.4	3.1	3.0	2.6	2.4	2.3	2.3	2.3	2.2
9	.....	2.0	2.0	2.4	3.2	3.0	2.6	2.3	2.3	2.3	2.3	2.1
10	.....	2.0	2.0	2.5	3.3	3.0	2.6	2.3	2.3	2.3	2.3	2.1
11	.....	2.0	2.0	2.8	3.4	2.9	2.6	2.3	2.3	2.3	2.2	2.1
12	.....	2.0	2.0	2.8	3.6	2.9	2.6	2.3	2.3	2.3	2.2	2.1
13	.....	2.0	2.0	2.9	3.6	3.0	2.6	2.3	2.3	2.3	2.2	2.2
14	.....	2.0	2.0	3.1	3.4	3.0	2.6	2.3	2.3	2.3	2.2	2.2
15	.....	2.0	2.0	3.2	3.2	3.0	2.6	2.3	2.3	2.3	2.2	2.2
16	.....	2.0	2.0	3.2	3.3	2.9	2.6	2.3	2.3	2.3	2.2	2.2
17	.....	2.0	2.0	3.2	3.3	2.9	2.6	2.3	2.3	2.3	2.2	2.1
18	.....	2.0	2.0	3.1	3.3	2.8	2.5	2.3	2.3	2.3	2.2	2.1
19	.....	2.0	2.3	3.0	3.3	2.8	2.5	2.3	2.3	2.3	2.2	2.1
20	.....	2.0	2.3	3.0	3.3	2.8	2.5	2.3	2.3	2.3	2.2	2.1
21	.....	2.0	2.4	2.9	3.3	2.8	2.5	2.3	2.3	2.3	2.2	2.2
22	.....	2.0	2.3	3.0	3.2	3.0	2.4	2.3	2.3	2.3	2.2	2.2
23	.....	2.0	2.3	3.1	3.2	3.0	2.4	2.3	2.3	2.3	2.2	2.2
24	.....	2.0	2.2	3.0	3.2	3.0	2.4	2.3	2.3	2.3	2.2	2.2
25	.....	2.0	2.2	3.0	3.2	3.0	2.4	2.3	2.3	2.3	2.2	2.2
26	.....	2.0	2.1	2.9	3.1	2.9	2.4	2.3	2.3	2.3	2.2	2.2
27	.....	2.0	2.1	2.9	3.1	2.9	2.4	2.3	2.3	2.3	2.2	2.2
28	.....	2.0	2.1	2.9	3.0	2.9	2.4	2.3	2.3	2.3	2.2	2.2
29	.....	.....	2.1	2.9	2.9	2.8	2.4	2.3	2.3	2.3	2.2	2.2
30	.....	.....	2.1	2.9	2.9	2.8	2.4	2.3	2.3	2.3	2.2	2.2
31	.....	.....	2.1	.....	2.9	.....	2.4	2.3	.....	2.3	.....	2.2
1908.												
1	2.2	2.1	2.1	2.1	2.7	2.7	2.7	2.3	2.3	2.2	2.2	2.2
2	2.2	2.1	2.1	2.1	2.6	2.8	2.7	2.3	2.3	2.2	2.2	2.1
3	2.2	2.1	2.1	2.1	2.6	2.9	2.7	2.3	2.3	2.2	2.2	2.1
4	2.2	2.1	2.1	2.1	2.7	3.0	2.6	2.3	2.3	2.3	2.2	2.1
5	2.2	2.1	2.1	2.1	2.7	3.2	2.6	2.3	2.3	2.3	2.2	2.1
6	2.2	2.1	2.1	2.1	2.7	3.7	2.6	2.3	2.3	2.3	2.2	2.1
7	2.2	2.1	2.1	2.1	2.7	3.4	2.6	2.3	2.3	2.2	2.2	2.1
8	2.2	2.1	2.1	2.1	2.7	3.3	2.6	2.2	2.3	2.2	2.2	2.1
9	2.2	2.1	2.1	2.1	2.7	3.3	2.6	2.2	2.3	2.2	2.2	2.1
10	2.2	2.1	2.1	2.2	2.7	3.3	2.5	2.2	2.3	2.2	2.2	2.1
11	2.2	2.1	2.1	2.2	2.7	3.2	2.5	2.2	2.3	2.2	2.2	2.1
12	2.2	2.1	2.1	2.2	2.7	3.2	2.5	2.2	2.2	2.2	2.2	2.1
13	2.2	2.1	2.1	2.4	2.7	3.2	2.5	2.2	2.2	2.2	2.2	2.1
14	2.2	2.1	2.1	2.6	2.8	3.1	2.5	2.2	2.2	2.2	2.2	2.1
15	2.2	2.1	2.1	2.7	2.8	3.1	2.5	2.2	2.2	2.7	2.2	2.1
16	2.2	2.1	2.1	2.8	2.8	3.0	2.5	2.3	2.2	2.6	2.2	2.1
17	2.2	2.1	2.1	2.9	2.7	3.0	2.5	2.3	2.2	2.5	2.2	2.1
18	2.2	2.1	2.1	3.1	2.7	3.3	2.5	2.3	2.3	2.4	2.2	2.1
19	2.2	2.1	2.1	3.3	2.7	3.2	2.5	2.3	2.3	2.3	2.2	2.1
20	2.2	2.1	2.1	3.5	2.7	3.3	2.4	2.3	2.3	2.3	2.2	2.1

Daily gage height, in feet, of North Fork of Snake River near Ora, Idaho, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21	2.2	2.1	2.1	3.5	2.7	3.3	2.4	2.3	2.2	2.3	2.2	2.1
22	2.2	2.1	2.1	3.4	2.6	3.3	2.4	2.3	2.2	2.3	2.2	2.1
23	2.1	2.1	2.1	3.4	2.6	3.2	2.4	2.3	2.2	2.3	2.2	2.1
24	2.2	2.1	2.1	3.3	2.6	3.1	2.4	2.3	2.2	2.3	2.2	2.1
25	2.2	2.1	2.1	3.1	2.7	3.1	2.4	2.3	2.2	2.3	2.2	2.1
26	2.1	2.1	2.1	2.9	2.9	3.0	2.4	2.3	2.2	2.3	2.2	2.1
27	2.1	2.1	2.1	2.8	2.8	2.9	2.4	2.3	2.2	2.3	2.2	2.1
28	2.1	2.1	2.1	2.7	2.8	2.9	2.3	2.3	2.2	2.2	2.2	2.1
29	2.1	2.1	2.1	2.7	2.8	2.8	2.3	2.3	2.2	2.2	2.2	2.1
30	2.1	.....	2.1	2.7	2.9	2.8	2.3	2.3	2.2	2.2	2.2	2.1
31	2.1	.....	2.1	.....	2.7	.....	2.3	2.3	.....	2.2	.....	2.1

NOTE.—Slush ice noted January 17 to February 1, and December 16 to 22, 1908, gage heights probably not affected.

Rating table for North Fork of Snake River near Ora, Idaho, for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	990	2.60	1,700	3.20	2,810
2.10	1,070	2.70	1,860	3.30	3,030
2.20	1,170	2.80	2,030	3.40	3,260
2.30	1,280	2.90	2,210	3.50	3,500
2.40	1,410	3.00	2,400	3.60	3,750
2.50	1,550	3.10	2,600	3.70	4,000

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 14 discharge measurements made during 1905–1908, and is well defined.

Monthly discharge of North Fork of Snake River near Ora, Idaho, for 1907 and 1908.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January [a]	.....	.....	990	0.952	1.10	60,900	A.
February [a]	.....	.....	990	.952	.99	55,000	A.
March	1,410	990	1,070	1.03	1.19	65,800	A.
April	2,810	1,070	2,030	1.95	2.18	121,000	A.
May	3,750	2,210	2,780	2.67	3.08	171,000	A.
June	2,400	2,030	2,240	2.15	2.40	133,000	A.
July	2,030	1,410	1,620	1.56	1.80	99,600	A.
August	1,410	1,280	1,310	1.26	1.45	80,600	A.
September	1,280	1,280	1,280	1.23	1.37	76,200	A.
October	1,280	1,280	1,280	1.23	1.42	78,700	A.
November	1,280	1,170	1,210	1.16	1.29	72,000	A.
December	1,170	1,070	1,140	1.10	1.27	70,160	A.
The year	3,750	990	1,500	1.44	19.54	1,080,000	
1908.							
January	1,170	1,070	1,150	1.11	1.28	70,700	A.
February	1,070	1,070	1,070	1.03	1.11	61,600	A.
March	1,070	1,070	1,070	1.03	1.19	65,800	A.
April	3,500	1,070	1,900	1.83	2.04	113,000	A.
May	2,210	1,700	1,890	1.82	2.10	116,000	A.
June	4,000	1,860	2,660	2.56	2.86	158,000	A.
July	1,860	1,280	1,540	1.48	1.71	94,700	A.
August	1,280	1,170	1,250	1.20	1.38	76,900	A.
September	1,280	1,170	1,220	1.17	1.30	72,600	A.
October	1,860	1,170	1,270	1.22	1.41	78,100	A.
November	1,170	1,170	1,170	1.12	1.25	69,600	A.
December	1,170	1,070	1,070	1.03	1.19	65,800	A.
The year	4,000	1,070	1,440	1.38	18.82	1,040,000	

[a] Discharge estimated at 990 second-feet throughout January and February, as it remains practically constant throughout the winter.

FALL RIVER AT FREMONT, IDAHO.

Fall River rises in the southwestern part of Yellowstone National Park and flows westward, uniting with the North Fork of the Snake near Chester, Idaho.

A gaging station was established January 1, 1904, about 900 feet from Fremont post-office, in order to determine the amount of flood water available for storage in the Fall River meadows.

As the river receives no important tributaries below the station, the records show practically the total run-off from the Fall River drainage area. One comparatively small irrigation canal diverts above the station.

The records are not affected by logging or artificial control of the water above, but are affected by ice during the winter months.

The gage datum has remained unchanged since the station was established.

The cross section is rather rough, but is permanent, and a good rating curve has been obtained. The records may be considered reliable for open channel conditions.

Discharge measurements of Fall River at Fremont, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage. height.	Discharge.
		Feet.	*Sq.ft.*	*Feet.*	*Sec.-ft.*
1907.					
May 24	A. D. Williams	151	424	3.70	2,360
June 12	do	151	430	3.80	2,390
July 6	do	153	452	4.05	2,710
July 23	do	150	320	3.25	1,560
August 20	do	144	240	2.30	762
1908.					
May 19	A. D. Williams	146	266	2.75	1,130

Daily gage height, in feet, of Fall River at Fremont, Idaho, for 1907 and 1908.

[Dot Sheetz, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1				1.9	2.8	3.5	3.7	2.8	2.3	2.25	2.5	2.1
2				2.0	2.8	3.6	3.8	2.75	2.5	2.25	2.5	2.1
3				2.1	2.8	3.7	3.8	2.6	2.3	2.25	2.4	2.05
4				2.1	2.8	3.6	4.0	2.6	2.3	2.25	2.4	2.0
5				2.0	2.85	3.8	4.15	2.6	2.2	2.2	2.4	2.0
6				2.0	2.9	4.2	4.05	2.5	2.2	2.2	2.3	2.0
7				2.0	3.0	4.1	4.0	2.4	2.2	2.2	2.3	2.0
8				2.0	3.1	4.3	3.9	2.4	2.2	2.2	2.1	2.0
9				2.0	3.3	4.2	3.9	2.4	2.2	2.2	2.1	2.0
10				2.1	3.6	3.7	3.9	2.35	2.2	2.1	2.0	1.9
11				2.2	3.55	3.6	3.7	2.4	2.2	2.1	2.0	1.9
12				2.3	3.7	3.8	3.6	2.4	2.25	2.1	2.0	1.9
13		1.8	1.7	2.4	3.25	3.7	3.55	2.3	2.25	2.2	2.0	1.9
14		1.8		2.6	3.15	3.6	3.55	2.2	2.2	2.5	2.0	1.95
15		1.8		2.9	3.15	3.5	3.7	2.2	2.2	2.5	2.0	1.95
16		1.8		2.9	3.55	3.3	3.3	2.2	2.2	2.1	2.0	1.9
17		1.8	1.7	2.8	3.65	3.15	3.1	2.2	2.2	2.5	2.1	1.9
18		1.8	1.7	2.7	3.65	3.15	3.2	2.4	2.2	2.1	2.1	1.9
19		1.8	1.9	2.5	3.9	3.25	3.1	2.3	2.2	2.1	2.0	1.8
20		1.8	2.0	2.5	3.9	3.4	3.1	2.3	2.15	2.1	2.0	1.8

Daily gage height, in feet, of Fall River at Fremont, Idaho, for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	.....	1.8	2.2	2.5	3.6	3.6	3.1	2.3	2.15	2.2	2.0	1.8
22	.....	1.8	2.3	2.5	3.65	4.1	3.2	2.3	2.15	2.2	2.1	1.8
23	.....	1.8	2.1	2.75	3.7	3.75	3.25	2.3	2.15	2.25	2.1	1.8
24	.....	.....	2.1	2.7	3.8	3.55	3.2	2.4	2.15	2.2	2.1	1.8
25	.....	.....	2.1	2.65	3.55	3.6	3.0	2.4	2.15	2.2	2.0	1.8
26	.....	.....	2.0	2.55	3.3	3.5	3.05	2.3	2.15	2.1	2.0	1.8
27	.....	.....	2.0	2.55	3.2	3.45	3.0	2.3	2.2	2.1	2.0	1.7
26	.....	.....	1.9	2.55	3.25	3.55	3.0	2.3	2.2	2.1	2.0	1.8
29	.....	.....	1.9	2.55	3.3	3.6	3.0	2.3	2.2	2.5	2.0	1.8
30	.....	.....	1.9	2.8	3.25	3.75	3.0	2.3	2.2	2.5	2.0	1.8
31	.....	.....	2.0	.....	3.3	.....	2.9	2.3	.....	2.5	.....	1.8
1908.												
1	1.8	1.8	1.8	1.9	2.9	3.7	3.6	2.0	2.1	2.1	1.9	1.85
2	1.8	1.7	1.8	1.9	2.9	3.7	3.6	2.0	2.1	2.1	1.9	1.9
3	1.8	1.6	1.8	1.9	2.9	3.7	3.6	2.0	2.1	2.1	1.9	1.9
4	1.8	1.6	1.85	1.9	2.9	3.75	3.6	1.9	2.1	2.1	1.9	1.9
5	1.7	1.6	1.85	1.9	2.9	3.75	3.6	1.9	2.1	2.1	1.9	1.9
6	1.7	1.6	1.8	1.9	2.9	3.75	3.6	1.9	2.1	2.05	1.9	1.9
7	1.8	1.65	1.8	1.9	2.9	3.8	3.6	1.9	2.1	2.05	1.9	1.9
8	1.8	1.7	1.8	1.9	2.9	3.8	3.7	1.9	2.1	2.05	1.9	1.9
9	1.8	1.7	1.8	1.9	2.9	3.8	3.7	1.9	2.1	2.05	1.9	1.9
10	1.9	1.6	1.8	1.9	2.9	3.8	3.7	1.9	2.1	2.05	1.9	1.9
11	1.9	1.6	1.9	1.9	2.9	3.8	3.4	1.9	2.1	2.05	1.9	1.95
12	1.9	1.6	1.9	2.0	2.9	3.7	3.4	1.9	2.1	2.05	1.9	1.95
13	1.9	1.6	1.9	2.0	2.9	3.8	3.4	1.9	2.1	2.05	1.9	1.95
14	1.9	1.6	1.9	2.2	2.9	3.8	3.3	1.95	2.1	2.05	1.9	1.95
15	1.9	1.7	1.9	2.4	2.9	3.8	3.3	2.0	2.1	2.05	1.9	2.0
16	1.9	1.7	1.9	2.6	2.9	3.8	3.1	2.25	2.1	2.05	1.9	2.0
17	1.9	1.7	1.95	2.8	2.9	3.8	3.0	2.25	2.1	2.05	1.85	2.0
18	1.9	1.7	2.0	2.8	2.9	3.9	2.9	2.25	2.1	2.1	1.85	2.1
19	1.9	1.75	1.95	2.9	2.9	4.2	2.9	2.25	2.15	2.1	1.85	2.1
20	1.9	1.75	1.95	3.0	2.9	4.2	2.9	2.2	2.15	2.1	1.85	2.1
21	1.9	1.75	1.95	3.2	2.9	3.9	2.8	2.2	2.15	2.1	1.85	2.15
22	1.9	1.75	1.9	3.2	2.8	3.9	2.8	2.2	2.15	1.9	1.85	2.15
23	1.9	1.8	1.9	3.2	2.7	3.9	2.7	2.15	2.15	1.9	1.9	2.2
24	1.9	1.8	1.9	3.25	2.7	3.8	2.7	2.15	2.15	1.9	1.9	2.2
25	1.9	1.8	1.9	2.9	2.65	3.8	2.7	2.15	2.15	1.9	1.9	2.2
26	1.9	1.8	1.9	2.9	2.65	3.7	2.7	2.1	2.1	1.9	1.9	2.15
27	1.9	1.8	1.9	2.9	2.6	3.7	2.6	2.1	2.1	1.9	1.9	2.15
28	1.9	1.8	1.9	2.9	3.25	3.7	2.55	2.1	2.1	1.9	1.9	2.1
29	1.8	1.8	1.9	2.8	3.7	3.7	2.3	2.1	2.1	1.9	1.9	2.1
30	1.8	.....	1.9	2.8	3.8	3.6	2.2	2.0	2.1	1.9	1.85	1.95
31	1.8	.....	1.9	.....	3.8	.....	2.1	2.0	.....	1.9	.....	1.95

Rating table for Fall River at Fremont, Idaho, for 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	255	2.30	700	3.00	1,335	3.70	2,205
1.70	305	2.40	775	3.10	1,445	3.80	2,345
1.80	365	2.50	860	3.20	1,565	3.90	2,495
1.90	425	2.60	945	3.30	1,685	4.00	2,655
2.00	485	2.70	1,035	3.40	1,815	4.10	2,810
2.10	555	2.80	1,125	3.50	1,945	4.20	2,970
2.20	625	2.90	1,225	3.60	2,075	4.30	3,130

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 14 discharge measurements made during 1905–1908 and is well defined above gage height 1.8 feet.

Monthly discharge of Fall River at Fremont, Idaho, for 1907 and 1908.

[Drainage area, 390 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 13–28	365	365	365	0.936	0.56	11,600	B.
March	700	305	408	1.05	1.21	25,100	A.
April	1,220	425	797	2.04	2.28	47,400	A.
May	2,500	1,120	1,750	4.49	5.18	108,000	A.
June	3,130	1,500	2,160	5.54	6.18	129,000	A.
July	2,890	1,220	1,900	4.87	5.62	117,000	A.
August	1,120	625	766	1.96	2.26	47,100	A.
September	860	590	635	1.63	1.82	37,800	A.
October	860	555	654	1.68	1.94	40,200	A.
November	860	485	570	1.46	1.63	33,900	A.
December	555	305	423	1.08	1.24	26,000	B.
The period	.....	.....	.....	.....	.....	623,000	
1908.							
January	425	305	398	1.02	1.18	24,500	B.
February	365	255	309	.792	.85	17,800	B.
March	485	365	413	1.06	1.22	25,400	A.
April	1,620	425	874	2.24	2.50	52,000	A.
May	2,340	945	1,300	3.33	3.84	79,900	A.
June	2,970	2,080	2,350	6.03	6.73	140,000	A.
July	2,200	555	1,500	3.85	4.44	92,200	A.
August	662	425	520	1.33	1.53	32,000	A.
September	590	555	563	1.44	1.61	33,500	A.
October	555	425	500	1.28	1.48	30,700	A.
November	425	395	418	1.07	1.19	24,900	A.
December	625	395	497	1.27	1.46	30,600	B.
The year	2,970	255	804	2.06	28.00	584,000	

TETON RIVER NEAR ST. ANTHONY, IDAHO.

Teton River is the most important tributary of the North Fork of the Snake, rises in the Teton Mountains south of the Yellowstone National Park, and flows westward uniting with the North Fork about 8 miles southwest of St. Anthony, Idaho.

The gaging station which was established April 23, 1903, to obtain data for use in connection with proposed irrigation work on Teton River and to determine the amount of flood water available for storage, is located at the bridge on the stage road from St. Anthony to Victor, Idaho.

No tributaries enter below the station, but the flow is affected by tributaries and a canal above the station and the records should therefore be used carefully.

The gage heights are not affected by logging or artificial control above, but are somewhat affected by ice during the winter months.

The gage datum has remained unchanged.

A good rating curve has been obtained and the records may be considered reliable.

Discharge measurements of Teton River near St. Anthony, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 22	A. D. Williams	79	503	3.90	2,560
July 5	do	80	542	4.45	2,780
July 22	do	80	434	3.05	1,600
August 19	do	80	366	2.25	821
1908.					
May 18	A. D. Williams	79	394	2.55	1,120

Daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1907 and 1908.

[Mrs. Priscilla Ferguson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[a]
1907.												
1	.....	.....	1.5	1.8	2.15	3.5	4.1	2.7	2.15	2.05	2.1	1.9
2	.....	.....	1.45	2.0	2.2	3.7	4.1	2.5	2.1	2.05	2.1	1.9
3	.....	.....	1.45	2.3	2.2	3.75	4.15	2.3	2.1	2.1	2.0	1.8
4	.....	.....	1.45	2.3	2.25	3.6	4.2	3.1	2.1	2.05	2.0	1.95
5	.....	.....	1.5	2.25	2.3	3.75	4.4	3.05	2.05	2.0	2.0	1.8
6	.....	.....	1.5	2.0	2.4	4.2	4.15	2.9	2.05	2.0	2.0	1.8
7	.....	.....	1.55	1.9	2.45	4.35	4.1	2.7	2.05	2.0	2.0	1.8
8	.....	.....	1.6	1.9	2.4	4.4	4.0	2.65	2.05	2.0	1.95	1.85
9	.....	.....	1.65	1.9	2.5	4.25	3.9	2.6	2.05	2.0	1.9	1.85
10	.....	1.4	1.65	2.1	2.7	3.55	3.75	2.55	2.1	2.0	1.85	1.9
11	.....	1.4	1.6	2.5	3.05	3.5	3.65	2.4	2.05	1.95	1.85	1.9
12	.....	1.4	1.6	2.35	3.35	3.65	3.5	2.35	2.0	1.9	2.0	1.85
13	.....	1.4	1.6	2.25	3.35	3.6	3.5	2.3	2.0	2.1	2.0	1.9
14	.....	1.35	1.55	2.45	3.0	3.65	3.55	2.3	2.0	2.1	1.95	1.9
15	.....	1.35	1.5	2.8	2.75	3.5	3.55	2.35	2.0	2.05	1.85	1.85
16	.....	1.35	1.5	2.8	2.85	3.45	3.35	2.35	2.0	2.0	1.85	1.85
17	.....	1.3	1.5	2.75	2.95	3.35	3.2	2.3	2.0	2.0	1.85	1.85
18	.....	1.3	1.6	2.55	3.75	3.2	3.1	2.2	2.05	2.0	1.85	1.9
19	.....	1.4	2.9	2.45	4.2	3.15	3.05	2.0	2.05	2.0	1.9	2.3
20	.....	1.4	2.65	2.3	4.4	3.35	3.0	2.1	2.0	2.0	1.9	2.3
21	.....	1.45	2.9	2.3	4.1	3.5	3.1	2.1	2.0	2.0	1.85	2.2
22	.....	1.5	2.75	2.15	3.95	3.7	3.1	2.1	2.05	2.0	1.95	2.25
23	.....	1.5	2.2	2.15	3.9	3.9	2.05	2.05	2.05	1.95	1.95	2.3
24	.....	1.55	2.1	2.2	4.15	3.55	3.0	2.1	2.0	1.95	1.95	2.3
25	.....	1.6	2.1	2.3	4.0	3.35	3.0	2.2	2.0	1.95	1.95	1.95
26	.....	1.55	1.9	2.2	3.55	3.55	2.95	2.1	2.0	2.1	1.8	1.95
27	.....	1.5	1.8	2.15	3.3	3.5	2.9	2.15	2.0	2.0	1.9	2.2
28	.....	1.5	1.75	2.05	3.25	3.6	2.9	2.2	2.0	2.0	1.9	2.2
29	.....	.....	1.7	2.0	3.2	4.0	2.85	2.15	2.0	2.1	1.85	2.2
30	.....	.....	1.7	2.1	3.2	4.0	2.8	2.1	2.0	2.15	1.9	2.05
31	.....	.....	1.7	.....	3.4	.....	2.7	2.05	.....	2.15	.....	2.05
1908.[b]												
1	2.25	3.0	1.6	1.7	2.1	3.2	3.9	2.4	2.1	1.9	1.9	1.95
2	2.25	3.0	1.6	1.7	2.3	3.15	3.95	2.4	2.05	1.9	1.9	1.95
3	2.25	3.0	1.6	1.7	2.35	3.1	4.0	2.3	2.05	1.95	1.9	1.95
4	2.25	3.0	1.65	1.7	2.7	3.3	4.15	2.3	2.0	1.95	1.85	2.0
5	2.35	3.0	1.65	1.7	2.6	3.35	4.3	2.3	2.0	1.95	1.85	2.0
6	2.35	3.3	1.6	1.7	2.7	3.5	4.25	2.3	2.0	1.9	1.85	1.95
7	2.35	3.3	1.6	1.7	2.85	3.85	4.1	2.25	2.0	1.9	1.85	1.8
8	2.35	3.3	1.65	1.7	3.25	4.1	4.0	2.25	2.0	1.9	1.8	1.8
9	2.35	3.3	1.65	1.7	3.3	4.4	3.95	2.25	2.0	1.9	1.8	1.8
10	2.35	3.3	1.65	1.7	3.3	4.15	3.85	2.25	2.0	1.9	1.8	1.8
11	2.35	3.3	1.65	1.7	3.25	4.35	3.75	2.2	2.0	1.9	1.8	1.8
12	2.5	3.3	1.65	1.7	3.0	4.5	3.7	2.15	2.0	1.9	1.8	1.8
13	2.5	3.3	1.65	1.75	2.75	4.5	3.7	2.15	2.1	1.9	1.75	1.85
14	2.5	3.3	1.65	2.0	2.5	4.55	3.7	2.15	2.1	1.9	1.75	1.9
15	2.7	3.3	1.65	2.2	2.4	4.85	3.65	2.15	2.05	2.0	1.75	1.95
16	2.7	3.3	2.0	2.25	2.55	5.25	3.7	2.15	2.0	2.1	1.75	1.95
17	2.7	2.85	3.4	2.3	2.5	5.9	3.5	2.15	2.0	2.2	1.75	2.0
18	2.7	2.4	3.0	2.3	2.45	5.7	3.25	2.15	2.0	2.1	1.8	2.0
19	2.7	1.7	2.6	2.4	2.5	5.1	3.25	2.1	2.0	2.0	1.8	2.0
20	2.7	1.7	2.0	2.6	2.55	4.45	3.2	2.1	2.0	2.0	1.8	1.25

[a] River probably frozen after about December 19.
[b] The river was frozen January 1 to February 18, and from about December 19 to 31.

Daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21	2.7	1.8	1.9	2.75	2.45	4.3	3.0	2.1	2.0	2.0	1.8	2.1
22	2.7	1.7	1.9	2.8	2.55	4.15	2.95	2.1	2.0	2.0	1.85	2.15
23	2.7	1.7	1.9	2.8	2.5	4.0	2.95	2.05	2.0	2.0	1.85	2.15
24	2.7	1.7	1.9	2.8	2.45	3.7	2.85	2.05	1.95	2.0	1.85	2.2
25	2.7	1.8	1.7	2.8	2.45	3.7	2.8	2.1	1.95	2.0	1.85	2.2
26	2.7	1.85	1.7	2.6	2.5	3.75	2.75	2.1	1.95	2.0	1.85	2.2
27	2.7	1.8	1.7	2.4	2.7	4.2	2.7	2.1	1.95	2.0	1.85	2.4
28	2.7	1.7	1.7	2.2	2.75	4.1	2.7	2.05	1.95	2.0	1.85	2.4
29	2.7	1.7	1.7	2.1	2.65	3.7	2.65	2.1	1.95	1.95	1.9	2.4
30	3.0	.....	1.7	2.0	2.55	3.8	2.65	2.05	1.95	1.95	1.9	2.4
31	3.0	.....	1.7	.....	3.0	.....	2.5	2.1	.....	1.95	.....	2.4

Rating table for Teton River near St. Anthony, Idaho, for 1905, 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	88	2.20	808	3.40	1,755	4.60	3,385
1.10	142	2.30	878	3.50	1,850	4.70	3,555
1.20	197	2.40	950	3.60	1,950	4.80	3,740
1.30	253	2.50	1,024	3.70	2,060	4.90	3,925
1.40	310	2.60	1,100	3.80	2,175	5.00	4,115
1.50	368	2.70	1,177	3.90	2,300	5.20	4,495
1.60	427	2.80	1,255	4.00	2,435	5.40	4,875
1.70	487	2.90	1,335	4.10	2,580	5.60	5,255
1.80	548	3.00	1,417	4.20	2,730	5.80	5,635
1.90	610	3.10	1,500	4.30	2,885	6.00	6,015
2.00	674	3.20	1,584	4.40	3,045		
2.10	740	3.30	1,669	4.50	3,215		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based upon 19 discharge measurements made during 1904–1908, and is well defined between gage heights 1.5 feet and 4.00 feet for 1907, and fairly well for 1908.

Monthly discharge of Teton River near St. Anthony, Idaho, for 1907 and 1908.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 10–28	427	253	329	0.343	0.24	12,400	B.
March	1,340	339	566	.590	.68	34,800	A.
April	1,260	548	844	.879	.98	50,200	A.
May	3,040	774	1,610	1.68	1.94	99,000	A.
June	3,040	1,540	2,060	2.15	2.40	123,000	A.
July	3,040	1,180	1,870	1.95	2.25	115,000	A.
August	1,500	674	925	.964	1.11	56,900	A.
September	774	674	697	.726	.81	41,500	A.
October	774	610	689	.718	.83	42,400	A.
November	740	548	630	.656	.73	37,500	A.
December[a]	.....	.....	572	.596	.69	35,200	B.
The period	3,040	253	.....	.....	.....	648,000	
1908.							
January[a]	.....	.....	500	.521	.60	30,700	C.
February[a]	.....	.....	474	.494	.53	27,300	C.
March	1,760	427	587	.611	.70	36,100	B.
April	1,260	487	768	.800	.89	45,700	B.
May	1,670	740	1,150	1.20	1.38	70,700	B.
June	5,820	1,500	2,800	2.92	3.26	167,000	B.
July	2,880	1,020	1,860	1.94	2.24	114,000	B.
August	950	707	790	.823	.95	48,600	B.
September	740	642	676	.704	.79	40,200	B.
October	808	610	654	.681	.79	40,200	B.
November	610	518	565	.589	.66	33,600	B.
December[a]	.....	.....	539	.561	.65	33,100	C.
The year	5,820	.....	947	.987	13.44	687,000	

[a] Discharges estimated for ice periods.

BLACKFOOT RIVER BASIN.

DESCRIPTION.

Blackfoot River rises on the western slopes of the Preuss Range, in the southeastern part of Bannock County, Idaho, and flows northwestward to a point about 6 miles east of Presto, whence its course is southwestward to its junction with the Snake at Blackfoot. It is about 80 miles long and much of its drainage area is mountainous.

BLACKFOOT RIVER NEAR ROSSFORK, IDAHO.

This station, which was established July 15, 1908, to determine the amount of water available for storage at the reservoir at Blackfoot Marsh, now under construction by the Indian Service, is located 200 feet below the wagon bridge at Rockyford, 1 mile below the dam, and 45 miles from Rossfork, the most convenient railway station. The discharges at this station can not yet be computed.

Discharge measurements of Blackfoot River near Rossfork, Idaho, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 16	E. C. La Rue	.....	.....	1.65	212
October 9	M. W. Irsfeld	68	87	1.9	226

Daily gage height, in feet, of Blackfoot River near Rossfork, Idaho, for 1908.

[W. N. Brashears, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.7	1.85	1.85	2.0	16	1.65	1.75	1.9	1.95	1.9
2	.....	1.7	1.85	1.85	1.9	17	1.65	1.8	1.9	2.0	1.85
3	.....	1.7	1.85	1.85	1.85	18	1.65	1.8	1.9	1.9	1.85
4	.....	1.7	1.85	1.85	1.9	19	1.65	1.8	1.9	1.85	2.0
5	.....	1.7	1.85	1.85	1.9	20	1.7	1.8	1.9	1.8	1.9
6	.....	1.7	1.85	1.85	1.9	21	1.7	1.8	1.9	1.9	2.1
7	.....	1.7	1.85	1.85	1.9	22	1.7	1.8	1.9	1.8	2.3
8	.....	1.7	1.85	1.85	1.85	23	1.7	1.8	1.9	1.9	2.3
9	.....	1.7	1.9	1.85	1.85	24	1.7	1.8	1.9	1.8	2.4
10	.....	1.7	1.85	1.85	1.8	25	1.7	1.8	1.9	1.85	2.4
11	.....	1.7	1.85	1.85	1.75	26	1.7	1.8	1.9	1.85	2.4
12	.....	1.7	1.85	1.85	1.8	27	1.7	1.8	1.9	1.8	2.4
13	.....	1.7	1.85	1.85	1.8	28	1.7	1.8	1.9	1.8	2.4
14	.....	1.7	1.85	1.9	1.8	29	1.7	1.8	1.9	2.3	2.3
15	1.65	1.7	1.9	1.85	1.85	30	1.7	1.8	1.85	2.0	2.3
						31	1.7	.....	1.85	.....	2.3

BLACKFOOT RIVER NEAR PRESTO, IDAHO.

This station, which was established April 17, 1903, to determine the flood waters available for storage, is located on the ranch of James Just, 2 miles west of Presto and about 15 miles from Blackfoot, Idaho.

No tributaries enter below the station and the tributaries above are small streams flowing 10 second-feet or less. Two irrigation canals divert above the station.

The records are not affected by logging or artificial control above, but are affected by ice during the winter months.

The gage datum has remained unchanged since the station was established.

The cross section is nearly permanent and a fair rating curve has been obtained. The records may be considered good.

Discharge measurements of Blackfoot River near Presto, Idaho, in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	E. C. La Rue	56	293	4.06	939
May 20	do	56	288	4.04	932
June 10	do	56	254	3.40	759
August 5	do	53	111	.05	94
1907.					
May 16	La Rue and Williams	59	442	6.08	1,580
May 29	A. D. Williams	62	432	5.70	1,450
June 14	do	60	342	4.30	1,080
July 8	do	57	201	1.85	450
July 25	do	56	173	1.30	314
August 22	do	56	161	.95	237
1908.					
May 21	A. D. Williams	57	162	1.05	293
August 7	G. T. Burridge	55	117	.05	123

Daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1907 and 1908.

[James Just, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[a]
1907.[a]												
1			1.6	1.7	5.45	5.1	3.0	1.2	1.05	1.15	1.5	1.5
2			1.55	1.75	5.5	4.95	2.85	1.15	1.0	1.25	1.55	1.5
3			1.3	1.8	5.4	4.5	2.6	1.2	1.0	1.2	1.55	1.4
4			1.3	2.45	5.5	4.35	2.35	1.3	1.0	1.2	1.6	1.35
5			1.4	3.15	5.55	4.4	2.2	1.15	1.0	1.15	1.6	1.4
6			1.2	3.2	5.6	4.4	2.0	1.15	1.05	1.2	1.6	1.4
7			1.15	3.0	5.55	4.25	1.95	1.1	1.05	1.2	1.6	1.3
8			1.1	3.1	5.5	4.2	1.8	1.1	1.0	1.25	1.55	1.3
9			1.1	3.35	5.55	4.35	1.85	1.2	1.1	1.25	1.6	1.4
10		1.3	1.0	3.9	5.4	4.3	1.8	1.0	1.1	1.25	1.6	1.5
11		1.3	1.15	4.75	5.4	4.15	1.65	1.0	1.05	1.25	1.55	1.5
12		1.35	1.1	5.7	5.55	4.2	1.5	.95	1.1	1.3	1.55	1.45
13		1.25	1.0	6.15	5.4	4.3	1.5	1.0	1.1	1.3	1.6	1.5
14		1.3	1.05	6.7	5.45	4.35	1.45	.9	1.1	1.3	1.55	1.5
15		1.2	.9	7.75	5.9	4.3	1.4	.85	1.05	1.4	1.6	1.6
16		1.1	1.0	8.5	6.05	4.2	1.4	.9	1.1	1.4	1.6	1.5
17		1.1	1.0	8.7	6.1	4.2	1.45	.9	1.05	1.45	1.6	1.5
18		1.0	1.2	8.7	6.0	4.25	1.4	.9	1.05	1.45	1.55	1.5
19		1.05	1.25	8.55	5.8	4.15	1.35	.9	1.1	1.4	1.5	1.6
20		1.0	1.3	8.5	5.75	4.1	1.3	.9	1.1	1.45	1.55	1.65
21		1.95	1.3	8.25	5.8	4.1	1.35	.85	1.1	1.45	1.55	1.7
22		1.85	1.45	7.8	5.6	3.9	1.3	.9	1.15	1.5	1.5	1.7
23		1.9	1.5	7.25	5.35	3.75	1.3	.9	1.1	1.5	1.5	1.65
24		1.9	1.8	6.9	5.0	3.7	1.35	.9	1.1	1.45	1.6	1.8
25		1.8	2.0	6.5	5.1	3.7	1.35	.95	1.1	1.5	1.55	1.8
26		1.85	1.6	6.15	5.25	3.6	1.3	.95	1.1	1.55	1.4	1.7
27		1.8	1.6	6.0	5.4	3.65	1.25	1.0	1.15	1.5	1.45	1.8
28		1.8	1.55	6.45	5.65	3.5	1.25	1.0	1.15	1.5	1.4	1.65
29			1.5	5.7	5.7	3.35	1.25	1.05	1.1	1.5	1.5	1.6
30			1.6	5.5	5.55	3.2	1.2	1.0	1.15	1.55	1.45	1.55
31			1.65		5.4		1.2	1.1		1.5		1.6

[a] River probably frozen until February 17, and began to freeze about December 9, 1907.

Daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	1.6	1.6	2.0	1.75	1.7	1.9	1.0	0.1	0.2	0.35	0.8	0.8
2	1.65	1.6	2.0	1.8	1.55	2.0	.7	.05	.3	.5	.8	.7
3	1.6	1.65	1.9	1.9	1.4	2.05	.8	.1	.2	.6	.9	.8
4	1.6	1.6	1.95	1.85	1.35	2.3	.7	.15	.15	.55	.8	.75
5	1.5	1.55	1.8	2.0	1.3	2.5	.6	.1	.2	.6	.8	.8
6	1.55	1.6	1.75	1.95	1.2	2.65	.65	.1	.2	.5	.85	.9
7	1.6	1.6	1.7	1.8	1.2	2.7	.55	.1	.2	.5	.75	.9
8	1.6	1.55	1.8	1.9	1.2	2.9	.55	.05	.15	.55	.8	.7
9	1.6	1.6	1.75	1.95	1.0	2.7	.5	.0	.1	.6	.9	.7
10	1.5	1.6	1.6	2.1	1.1	2.5	.4	.0	.15	.5	.75	.75
11	1.45	1.7	1.2	2.7	1.2	2.55	.35	.0	.15	.6	.8	.5
12	1.45	1.65	.9	2.9	1.15	2.4	.35	.05	.2	.55	.8	.6
13	1.5	1.7	.9	2.9	1.2	2.25	.3	.1	.2	.7	.8	.55
14	1.5	1.75	.7	2.85	1.35	2.05	.35	.1	.2	.65	.85	.6
15	1.55	1.7	.85	3.0	1.25	2.0	.2	.15	.25	.8	.8	.7
16	1.6	1.65	.8	3.1	1.25	2.0	.2	.1	.25	1.0	.8	.8
17	1.6	1.65	1.0	3.3	1.25	1.8	.2	.1	.2	.9	.9	.75
18	1.7	1.6	1.2	3.15	1.1	1.85	.15	.1	.25	.95	.8	.9
19	1.65	1.6	1.35	3.2	1.15	1.8	.1	.05	.2	.9	.75	1.3
20	1.6	1.7	1.7	3.05	1.1	1.9	.1	.3	.2	1.0	.8	1.3
21	1.75	1.7	2.0	3.0	1.1	1.8	.05	.2	.25	.9	.85	1.25
22	1.8	1.75	1.75	2.8	1.0	1.85	.05	.2	.25	.9	.9	1.0
23	1.8	1.7	1.7	2.75	1.05	1.7	.05	.2	.3	.95	.95	1.0
24	1.75	1.8	1.8	2.55	1.15	1.55	.1	.15	.3	.9	.9	.9
25	1.8	1.75	1.75	2.4	1.2	1.55	.05	.2	.25	1.0	.85	1.1
26	1.6	1.8	1.75	2.25	1.3	1.5	.1	.2	.35	.9	.8	1.0
27	1.6	1.9	1.7	2.1	1.25	1.3	.05	.25	.3	.9	.8	1.2
28	1.7	2.0	1.7	2.05	1.4	1.35	.05	.2	.3	.95	.75	1.15
29	1.75	2.0	1.55	1.9	1.65	1.3	.05	.15	.3	.95	.7	1.0
30	1.8	.....	1.6	1.7	1.6	1.1	.05	.15	.4	.85	.8	.9
31	1.7	.....	1.6	.....	1.8	.....	.1	.2	.....	.8	.....	1.0

[a] The river was frozen January 1 to March 11, 1908; the ice was 14 inches thick February 17. Ice began to form along the edges December 18, and the river was frozen over December 20.

Rating tables for Blackfoot River near Presto, Idaho.

MARCH 8, 1906, TO APRIL 24, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	121	1.80	371	3.10	686	4.40	1,029
.60	135	1.90	393	3.20	712	4.50	1,057
.70	150	2.00	415	3.30	738	4.60	1,085
.80	167	2.10	438	3.40	764	4.70	1,113
.90	185	2.20	461	3.50	790	4.80	1,142
1.00	205	2.30	485	3.60	816	4.90	1,171
1.10	225	2.40	509	3.70	842	5.00	1,200
1.20	245	2.50	533	3.80	868	5.10	1,230
1.30	265	2.60	558	3.90	894	5.20	1,260
1.40	286	2.70	583	4.00	920	5.30	1,290
1.50	307	2.80	608	4.10	947	5.40	1,320
1.60	328	2.90	634	4.20	974	5.50	1,350
1.70	349	3.00	660	4.30	1,001		

APRIL 25, 1906, TO AUGUST 31, 1906.[b]

0.00	88	0.80	213	1.60	354	2.40	522
.10	100	.90	230	1.70	373	2.50	545
.20	114	1.00	247	1.80	393	2.60	568
.30	129	1.10	264	1.90	414	2.70	591
.40	145	1.20	281	2.00	435	2.80	614
.50	162	1.30	299	2.10	456	2.90	637
.60	179	1.40	317	2.20	477	3.00	660
.70	196	1.50	335	2.30	499		

[a] This table is not applicable for ice or obstructed channel conditions. It is based on five discharge measurements made during the latter part of 1905 and early part of 1906 and is well defined.

[b] This table is not applicable for ice or obstructed channel conditions. It is based on four discharge measurements made during 1906 and is well defined. Above gage height 3.0 feet it is the same as the previous table.

Rating tables for Blackfoot River near Presto, Idaho—Continued.

SEPTEMBER 1, 1906, TO APRIL 17, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	88	1.50	356	3.00	714	5.00	1,266
0.10	100	1.60	378	3.10	740	5.20	1,322
0.20	114	1.70	400	3.20	766	4.40	1,380
0.30	129	1.80	422	3.30	792	4.60	1,440
0.40	145	1.90	446	3.40	818	5.80	1,500
0.50	162	2.00	470	3.50	846	6.00	1,560
0.60	179	2.10	494	3.60	874	6.20	1,620
0.70	197	2.20	518	3.70	902	6.40	1,680
0.80	215	2.30	542	3.80	930	6.60	1,740
0.90	234	2.40	566	3.90	958	6.80	1,800
1.00	253	2.50	590	4.00	986	7.00	1,860
1.10	273	2.60	614	4.20	1,042	8.00	2,160
1.20	293	2.70	638	4.40	1,098	9.00	2,460
1.30	314	2.80	662	4.60	1,154		
1.40	335	2.90	688	4.80	1,210		

APRIL 18 TO DECEMBER 31, 1908.[b]

0.00	117	0.90	264	1.80	447	2.70	648
0.10	130	1.00	284	1.90	468	2.80	672
0.20	144	1.10	304	2.00	490	2.90	696
0.30	159	1.20	324	2.10	512	3.00	720
0.40	175	1.30	344	2.20	534	3.10	744
0.50	192	1.40	364	2.30	556	3.20	768
0.60	209	1.50	384	2.40	578	3.30	794
0.70	227	1.60	405	2.50	600	3.40	820
0.80	245	1.70	426	2.60	624	3.50	846

[a] This table is not applicable for ice or obstructed channel conditions. It is based on six discharge measurements made during 1907 and one in 1906 and is well defined. Below gage height 0.6 foot it is the same as the previous table.

[b] This table is not applicable for ice or obstructed channel conditions. It is based on two discharge measurements made during 1908 and earlier high-water measurements, and is well defined.

Monthly discharge of Blackfoot River near Presto, Idaho, for 1906 to 1908.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	.....	.....	150	0.147	0.17	9,220	C.
February	.....	.....	150	.147	.15	8,330	C.
March	349	.....	196	.192	.22	12,100	B.
April	1,350	150	552	.541	.60	32,800	A.
May	1,040	602	813	.797	.92	50,000	A.
June	960	272	582	.571	.64	34,600	A.
July	290	100	179	.175	.20	11,000	A.
August	162	88	113	.111	.13	6,950	A.
September	215	154	183	.179	.20	10,900	A.
October	253	197	225	.221	.25	13,800	A.
November	273	.....	254	.249	.28	15,100	B.
December	.....	.....	250	.245	.28	15,400	C.
The year	1,350	.....	304	.298	4.04	220,000	
1907.							
January	.....	.....	250	.245	.28	15,400	C.
February	458	.....	304	.298	.31	16,900	B.
March	470	234	321	.315	.36	19,700	A.
April	2,370	400	1,460	1.43	1.60	86,900	A.
May	1,590	1,270	1,430	1.40	1.61	87,900	A.
June	1,290	766	1,020	1.00	1.12	60,700	A.
July	714	293	391	.383	.44	24,000	A.
August	314	224	256	.251	.29	15,700	A.

Monthly discharge of Blackfoot River near Presto, Idaho, for 1906 to 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
September	283	253	269	0.264	0.29	16,000	A.
October	367	283	328	.322	.37	20,200	A.
November	378	335	366	.359	.40	21,800	A.
December	422	.....	309	.303	.35	19,000	C.
The year	2,370	.....	559	.548	7.42	404,000	
1908.							
January	.....	.....	250	.245	.28	15,400	C.
February	.....	.....	200	.196	.21	11,500	C.
March	470	.....	291	.285	.33	17,900	B.
April	792	411	578	.567	.63	34,400	A.
May	447	284	339	.332	.38	20,800	A.
June	696	304	491	.481	.54	29,200	A.
July	284	124	163	.160	.18	10,000	A.
August	159	117	134	.131	.15	8,240	A.
September	175	130	149	.146	.16	8,870	A.
October	284	167	237	.232	.27	14,600	A.
November	274	227	249	.244	.27	14,800	A.
December	264	.....	217	.213	.25	13,300	B.
The year	.....	.....	275	.269	3.65	199,000	

NOTE.—Discharges have been estimated for frozen periods.
The above monthly estimates for 1906 supersede those published in Water-Supply Paper 214.

BIG LOST RIVER NEAR CHILLY, IDAHO.

Big Lost River rises in the southern part of Custer County, Idaho, flows northeastward to a point about 3 miles southeast of Chilly, then turns abruptly and flows southeastward for about 50 miles. About 15 miles below Lost River it makes another turn to the northeast and 25 miles farther on its waters are lost in a sink.

This station, which was established April 25, 1904, discontinued August 31, 1906, and reestablished July 1, 1907, is located at Howell's ranch, the last one on the left bank, about 25 miles upstream from Mackay, Idaho, 7 miles from Chilly, and 3 miles above Kinickinick Point.

The object of the station is to determine the amount of water available for storage at the reservoir site 3 miles above Mackay.

Until April 20, 1906, the gage was located one-fourth mile from the ranch. It was moved in order to place it on the main channel.

The stream receives no tributaries of any importance below the station. One small irrigation ditch diverts above the station.

The gage heights are not affected by logging or artificial control above the station, but ice prevails to such an extent that it is necessary to discontinue readings for about three months in the winter.

The channel section is permanent and a good rating curve has been obtained. The records may be considered reliable.

The following measurement was made October 4, 1907:

Width, 80 feet; area, 140 square feet; gage height, 2.50 feet; discharge, 207 second-feet.

Daily gage height, in feet, of Big Lost River near Chilly, Idaho, for 1907 and 1908.

[Maud Howell, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1907.[a]						1907.					
1	4.8	3.85	2.8	2.5	2.5	16	4.0	3.15	2.65	2.45	2.4
2	4.8	3.85	2.8	2.5	2.5	17	3.9	3.1	2.65	2.45	.....
3	4.85	4.0	2.85	2.5	2.5	18	4.0	3.1	2.65	2.45	.....
4	.....	3.85	2.85	2.5	2.5	19	4.1	3.1	2.6	2.45	.....
5	.....	3.7	2.9	2.5	2.4	20	4.25	3.0	2.6	2.45	.....
6	.....	3.55	2.85	2.5	2.4	21	4.15	3.0	2.6	2.45	.....
7	4.8	3.55	2.85	2.5	2.4	22	4.1	3.0	2.6	2.45	.....
8	4.8	3.5	2.8	2.5	2.4	23	4.05	3.0	2.6	2.45	.....
9	4.75	3.45	2.8	2.5	2.4	24	4.05	3.1	2.6	2.45	.....
10	4.65	3.3	2.8	2.5	2.4	25	4.0	3.1	2.5	2.45	.....
11	4.65	3.3	2.75	2.5	2.4	26	4.0	3.05	2.5	2.45	.....
12	4.6	3.2	2.7	2.5	2.4	27	4.05	3.0	2.5	2.45	.....
13	4.5	3.2	2.7	2.45	2.4	28	3.95	2.9	2.5	2.5	.....
14	4.35	3.2	2.7	2.45	2.4	29	3.95	2.9	2.5	2.5	.....
15	4.2	3.2	2.7	2.45	2.4	30	3.9	2.85	2.5	2.5	.....
						31	3.85	2.8	.....	2.5	.....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1908.[b]									
1	.....	1.95	2.7	3.0	4.2	3.05	2.5	2.5	2.5
2	.....	1.9	2.8	3.05	4.2	3.1	2.5	2.5	2.5
3	.....	2.0	2.8	3.1	4.4	2.95	2.5	2.5	2.5
4	.....	2.05	2.8	3.1	4.5	2.9	2.5	2.5	2.45
5	.....	2.05	2.8	3.1	4.35	2.9	2.5	2.5	2.45
6	.....	2.05	2.9	3.25	4.0	3.0	2.5	2.5	2.45
7	.....	2.0	3.1	3.4	4.05	2.9	2.5	2.5	2.45
8	.....	2.05	3.05	3.65	4.0	2.9	2.7	2.5	2.45
9	.....	2.05	3.0	3.9	4.05	2.9	2.6	2.5	2.4
10	.....	2.05	3.0	4.1	3.9	2.9	2.55	2.5	2.4
11	.....	2.1	2.9	4.1	3.9	2.8	2.5	2.5	2.4
12	.....	2.2	2.8	4.35	3.9	2.8	2.6	2.5	2.5
13	.....	2.25	2.8	4.5	3.85	2.7	2.55	2.5	2.5
14	.....	2.3	2.7	4.65	4.0	2.8	2.55	2.55	2.5
15	.....	2.3	2.8	4.7	3.85	2.8	2.6	2.8	2.4
16	.....	2.4	2.8	4.6	3.65	2.7	2.55	2.85	2.35
17	.....	2.3	2.75	4.45	3.55	2.7	2.6	2.75	2.4
18	.....	2.4	2.7	4.2	3.45	2.7	2.65	2.6	2.4
19	.....	2.5	2.7	4.05	3.4	2.9	2.6	2.6	2.4
20	.....	2.6	2.7	3.8	3.4	2.85	2.6	2.6	2.4
21	.....	2.7	2.7	3.7	3.4	2.85	2.6	2.6	2.4
22	.....	2.8	2.7	3.6	3.4	2.8	2.6	2.6	2.4
23	.....	2.75	2.7	3.5	3.4	2.75	2.55	2.6	2.4
24	.....	2.7	2.7	3.55	3.35	2.7	2.5	2.6	2.35
25	.....	2.6	2.75	3.7	3.3	2.7	2.5	2.6	2.4
26	.....	2.6	2.8	4.1	3.25	2.7	2.5	2.6	2.45
27	.....	2.6	2.8	4.1	3.2	2.65	2.5	2.55	2.45
28	.....	2.6	2.8	4.0	3.2	2.6	2.5	2.55	2.45
29	1.95	2.6	2.9	3.9	3.1	2.6	2.5	2.55	2.45
30	2.0	2.6	2.95	4.1	3.05	2.55	2.5	2.5	2.45
31	1.95	.....	3.0	.....	3.0	2.55	.....	2.5	.....

[a] River frozen over from November 17 to December 31.
[b] Ice conditions—January 1 to March 28, and November 17 to December 31.

NOTE.—The 1906 rating table is believed to apply fairly well to these gage heights, but as the only measurement made in 1907–8 plots 12 per cent smaller than this table, no discharges have been computed.

BIG WOOD RIVER NEAR SHOSHONE, IDAHO.

Big Wood (Malade) River rises near Galena Peak, in the northern part of Blaine County, Idaho, and flows southward and southwestward to its point of junction with Snake River in the western part of Lincoln County. It is about 100 miles long and drains an area about 4,500 square miles in extent. It receives a numbe rof tributaries, the most important being Camas Creek and Little Wood River.

The gaging station, which was established June 5, 1905, discontinued December 31, 1906, and reestablished March 7, 1908, is located at A. D. Silva's ranch, 1 mile below the steel wagon bridge and 7 miles northwest of Shoshone, Idaho. The data obtained are used to determine the amount of water available for storage at this reservoir.

Little Wood River joins Big Wood River about 15 miles below the station, and the main tributary is Camas Creek about 26 miles above.

A reservoir dam is now under construction at the Cottonwoods, 15 miles above, where the whole flow of the river will be stored for the irrigation of a tract east of Shoshone, Idaho.

The records are not affected by ice, logging, or artificial control above.

The gage datum has remained unchanged since the station was established.

The cross section is permanent and a good rating curve has been obtained. The records may be considered very reliable.

Discharge measurements of Big Wood River near Shoshone, Idaho, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 15	A. D. Williams	87	159	3.30	221
November 18	E. C. La Rue	84	105	2.60	66.4

NOTE.—Measurements were made from a boat.

Daily gage height, in feet, of Big Wood River near Shoshone, Idaho, for 1908.

[A. D. Silva, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.95	3.7	3.2	4.4	2.75	.....	2.2	2.65	2.8
2	.....	3.9	3.65	3.4	4.5	2.6	.....	2.25	2.7	2.8
3	.....	3.7	3.8	3.5	4.7	2.55	.....	2.25	2.7	2.8
4	.....	3.7	3.8	3.6	4.8	2.5	.....	2.3	2.7	2.7
5	.....	3.7	3.75	3.8	4.8	2.3	.....	2.35	2.65	2.6
6	.....	3.8	3.65	3.8	4.95	2.2	.....	2.4	2.65	2.55
7	2.7	3.9	3.6	3.9	4.65	2.0	.....	2.4	2.6	2.6
8	2.7	3.85	3.6	4.05	4.5	1.9	.....	2.4	2.6	2.55
9	2.65	3.85	3.55	4.3	4.5	.....	.....	2.45	2.55	2.6
10	2.65	4.1	3.6	4.55	4.4	.....	.....	2.45	2.6	2.6

Daily gage height, in feet, of Big Wood River near Shoshone, Idaho, for 1908—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.75	3.75	3.6	4.7	4.3	.....	.....	2.4	2.65	2.6
12	2.8	3.8	3.6	4.8	4.2	.....	.....	2.4	2.65	2.7
13	3.0	3.8	3.5	5.0	4.1	.....	.....	2.5	2.7	2.6
14	3.1	4.1	3.3	5.15	4.1	.....	.....	2.55	2.7	2.6
15	3.2	4.4	3.3	5.3	4.3	.....	.....	2.6	2.65	2.55
16	3.05	4.4	3.35	5.4	4.2	.....	.....	2.8	2.65	3.2
17	3.6	4.4	3.25	5.55	4.0	.....	.....	3.0	2.6	2.2
18	4.5	4.3	3.15	5.5	3.8	.....	.....	3.0	2.6	2.2
19	4.05	4.2	3.0	5.3	3.7	.....	.....	2.85	2.6	2.6
20	3.75	4.2	3.2	5.0	3.5	.....	.....	2.85	2.6	2.4
21	3.9	4.35	3.2	4.95	3.4	.....	.....	2.85	2.7	2.2
22	4.1	4.4	3.1	4.8	3.4	.....	.....	2.8	2.7	2.0
23	4.2	4.4	3.1	4.7	3.4	.....	.....	2.8	2.7	2.1
24	4.5	4.4	3.0	4.4	3.3	.....	1.85	2.75	2.7	2.4
25	4.55	4.4	3.0	4.25	3.3	.....	1.9	2.7	2.7	2.4
26	4.65	4.3	3.0	4.1	3.2	.....	2.0	2.7	2.8	2.5
27	4.95	4.2	2.9	4.5	3.1	.....	2.05	2.7	2.7	2.55
28	4.65	4.0	3.0	4.5	3.0	.....	2.1	2.7	2.7	2.5
29	4.45	4.0	2.95	4.4	2.9	.....	2.1	2.65	2.8	2.5
30	4.2	3.8	3.0	4.3	2.9	.....	2.15	2.65	2.8	2.5
31	4.05	.....	2.9	.....	2.7	.....	.....	2.65	.....	2.55

NOTE.—The river was dry August 9 to September 23, and frozen after December 16.

Rating table for Big Wood River near Shoshone, Idaho, for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	0	2.80	106	3.70	340	4.60	685
2.00	9	2.90	124	3.80	375	4.70	735
2.10	19	3.00	145	3.90	410	4.80	790
2.20	29	3.10	170	4.00	445	4.90	845
2.30	40	3.20	195	4.10	480	5.00	900
2.40	51	3.30	220	4.20	515	5.20	1,010
2.50	63	3.40	250	4.30	550	5.40	1,120
2.60	76	3.50	280	4.40	590	5.60	1,230
2.70	90	3.60	310	4.50	635		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 12 discharge measurements made during 1905–8 and is well defined between gage heights 2.5 feet and 6.5 feet.

Monthly discharge of Big Wood River near Shoshone, Idaho, for 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
March 7–31	872	83	383	19,000	A.
April	590	340	470	28,000	A.
May	375	124	235	14,400	A.
June	1,200	195	673	40,000	A.
July	872	90	437	26,900	A.
August	98	0	12.4	762	B.
September	24	0	2.83	168	C.
October	145	29	78.1	4,800	B.
November	106	70	86.0	5,120	A.
December 1–15	106	70	82.7	2,460	A.
The period	.....	.....	.....	142,000	

SUCCOR CREEK NEAR HOMEDALE, IDAHO.

Succor Creek rises in the Mahogany Mountains in the eastern part of Malheur County, Oreg., flows northeastward, and joins Snake River near Homedale, Idaho.

The gaging station, which was established March 19, 1903, in order to determine the amount of water which wastes annually into Snake River, was originally located at a small truss bridge built to carry a flume, about one-half mile above the mouth of the creek. It has been moved twice, the second time on August 28, 1907, when the cable was moved about one-fourth mile downstream. On January 24, 1908, a new chain gage was installed at a point about 200 feet above the cable.

The station is below all tributaries and diversion canals. The entire low-water flow is diverted and used for irrigation above.

Gage heights are affected only by changes in the channel. The cross section is not permanent and a new rating must be obtained each year. The records are only fair.

Discharge measurements of Succor Creek near Homedale, Idaho, in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1906.					
April 3	E. C. La Rue	45	71	1.65	370
1907.					
February 4	E. C. La Lue	54	106	2.35	738
February 19	do	37	33	.85	69
1908.					
January 24 [a]	A. D. Williams	12	6.2	1.20	9.6
February 21	Williams and Tracy	10	5.0	1.25	7.3
March 16	F. E. Tracy	67	38.0	1.6	75.0
Do	do	65	68.0	2.15	161.0

[a] Measured from foot bridge, below cable.

Daily gage height, in feet, of Succor Creek near Homedale, Idaho, for 1907 and 1908.

[Mrs. Minnie Tracy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	Dec.
1907.[a]											
1	2.4	2.95	0.85	1.2	.....	16	2.3	0.85	0.75	1.1	1.1
2	2.4	2.6	.85	1.1	.....	17	2.3	.85	.9	1.0	1.2
3	2.35	3.35	.85	1.1	.....	18	2.3	.85	1.4	1.0	1.2
4	2.45	2.6	.85	1.0	.....	19	2.3	.85	2.05	.95	1.3
5	2.5	2.55	.9	1.0	.....	20	2.3	.85	1.7	1.0	1.4
6	2.45	2.2	1.15	1.0	.....	21	2.3	.9	1.95	1.0	1.5
7	2.4	2.05	1.0	1.2	.....	22	2.3	.9	1.4	.95	1.5
8	2.4	1.65	.9	1.2	.....	23	2.3	.85	1.2	.9	1.6
9	2.3	1.15	.85	1.15	.....	24	2.3	.85	1.0	.9	1.8
10	2.3	1.1	.85	1.1	.....	25	2.3	.85	.95	.85	1.9
11	2.4	1.0	.85	1.0	.....	26	2.4	.85	.9	.8	2.0
12	2.4	1.0	.85	1.0	.....	27	2.4	.85	.9	.8	1.75
13	2.3	1.0	.8	1.1	.....	28	2.45	.85	.9	.7	1.2
14	2.3	.95	.75	1.5	.....	29	4.5	.....	1.0	.....	1.2
15	2.3	.9	.75	1.2	1.1	30	3.4	.....	1.0	.....	1.1
						31	3.0	.....	1.2	.....	1.2

[a] Stream was dry from latter part of June until about December 1.

Daily gage height, in feet, at Succor Creek near Homedale, Idaho, for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	1.2	1.2	1.35	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2
2	1.1	1.2	1.3	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2
3	1.1	1.25	1.25	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2
4	1.1	1.3	1.2	1.05	1.0	2.6	.....	.....	.....	.....	.....	1.2
5	1.0	1.3	1.15	1.05	1.0	2.1	.....	.....	.....	.....	.....	1.2
6	1.0	1.25	1.15	1.0	1.0	2.0	.....	.....	.....	.....	.....	1.2
7	1.0	1.2	1.05	1.0	1.0	.....	.....	.....	.....	.....	.....	1.2
8	1.05	1.2	1.05	1.0	1.0	.....	.....	.....	.....	.....	.....	1.2
9	1.05	1.25	1.05	1.0	1.0	.....	.....	.....	.....	.....	.....	1.2
10	1.05	1.25	1.05	1.0	.....	.....	.....	.....	.....	.....	.....	1.2
11	1.05	1.2	1.05	1.0	.....	.....	.....	.....	.....	.....	.....	1.2
12	1.0	1.2	1.1	1.0	.....	.....	.....	.....	.....	.....	.....	1.2
13	1.0	1.2	1.15	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
14	1.0	1.1	1.25	1.0	.....	.....	.....	.....	.....	.....	.....	1.25
15	1.0	1.1	1.4	1.0	.....	.....	.....	.....	.....	.....	.....	1.25
16	1.0	1.15	2.25	1.0	.....	.....	.....	.....	.....	.....	.....	1.25
17	1.0	1.25	1.9	1.0	.....	.....	.....	.....	.....	.....	.....	1.25
18	1.0	1.3	1.85	1.0	.....	.....	.....	.....	.....	.....	.....	1.25
19	1.0	1.2	1.6	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
20	1.0	1.25	1.5	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
21	1.0	1.2	1.4	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
22	1.1	1.15	1.4	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
23	1.15	1.15	1.2	1.0	.....	.....	.....	.....	.....	.....	.....	1.3
24	1.1	1.15	1.15	1.0	.....	.....	.....	.....	.....	.....	1.4	1.3
25	1.2	1.15	1.1	1.0	.....	.....	.....	.....	.....	.....	1.2	1.3
26	1.2	1.2	1.05	1.0	.....	.....	.....	.....	.....	.....	1.15	1.3
27	1.2	1.2	1.05	1.0	.....	.....	.....	.....	.....	.....	1.15	1.3
28	1.2	1.45	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2	1.4
29	1.2	1.4	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2	1.4
30	1.2	.....	1.05	1.0	.....	.....	.....	.....	.....	.....	1.2	1.5
31	1.2	.....	1.05	.....	.....	.....	.....	.....	.....	.....	.....	1.6

[a] The creek was frozen February 1 to 4 and December 4. There was no appreciable discharge May 10 to June 3 and June 7 to November 23.

Rating tables for Succor Creek near Homedale, Idaho.

JANUARY 1, 1906, TO FEBRUARY 3, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	6	2.90	40	3.50	114	4.10	281
2.40	9	3.00	50	3.60	134	4.20	316
2.50	13	3.10	60	3.70	157	4.30	352
2.60	18	3.20	71	3.80	184	4.40	389
2.70	24	3.30	83	3.90	214	4.50	426
2.80	31	3.40	97	4.00	247		

FEBRUARY 4, 1907, TO APRIL 28, 1907.[b]

0.50	8	1.10	146	1.70	392	2.30	706
.60	18	1.20	182	1.80	440	2.40	762
.70	34	1.30	220	1.90	490	2.50	818
.80	56	1.40	260	2.00	542	2.60	874
.90	82	1.50	302	2.10	596		
1.00	112	1.60	346	2.20	650		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1906, and is not well defined below gage height 3.5 feet. This table applies to the gage used January 31, 1905 to February 3, 1907.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1906–7, and is fairly well defined.

Rating tables for Succor Creek near Homedale, Idaho—Continued.

DECEMBER 15, 1907, TO DECEMBER 31, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1.00	1	1.50	48	1.90	118	2.30	196
1.10	2	1.60	64	2.00	136	2.40	216
1.20	6	1.70	82	2.10	156	2.50	236
1.30	18	1.80	100	2.20	176	2.60	256
1.40	32						

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908, and is not well defined.

Monthly discharge of Succor Creek near Homedale, Idaho, for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	426	6	25.4	1,560	D.
February	874	18	186	10,300	B.
March	569	45	139	8,550	B.
April 1–28	302	34	125	6,940	B.
December 15–31	136	2	40.8	2,510	C.
The period				29,900	
1908.					
January	6	1	2.61	160	D.
February	40	2	9.93	571	D.
March	186	1.5	23.8	1,460	C.
April	1.5	1.0	1.08	64.3	D.
May	1.0	0.0	.29	17.8	D.
June	256	0.0	18.3	1,090	D.
November	32	0.0	2.13	127	D.
December	64	6	15.7	965	D.
The period				4,460	

NOTE.—The above discharges give practically the yearly total, as the creek is dry all summer.

OWYHEE RIVER BASIN.

DESCRIPTION.

Owyhee River rises in the Independence Forest Reserve in the north-central portion of Nevada, flows north, then northwest across the corner of Idaho and into Oregon, where it turns abruptly and flows northeastward to its junction with Snake River, near Nyssa, Oreg., exactly opposite the mouth of Boise River in Idaho. The total length of the river is about 220 miles, and the drainage area comprises 11,100 square miles.

The country drained is an exceedingly arid desert, the annual precipitation ranging from 6 to 9 inches, the larger part occurring as snowfall. Forests are entirely lacking except on the extreme headwaters, and even there they are small and the trees are those characteristic of arid sections. The general elevation of the river basin is about 4,000 feet, and the altitudes have but little effect on the precipitation. The streams are frequently frozen for a considerable period during the winter months, so that records for this part of the

year are subject to inaccuracies. The low-water flow of this stream at the mouth is nearly all taken by a large canal for the irrigation of lands lying between the Owyhee and Malheur rivers. On the upper portions of the river conditions are favorable for impounding the flood and winter flows for irrigation during the summer months; but as the region is without transportation facilities, very little is known concerning its topography, geology, or hydrography.

One gaging station has been maintained in this drainage basin and that at the mouth of the river. Records have been obtained at this point (1890 to 1896 and 1903 to 1908).

OWYHEE RIVER AT OWYHEE, OREG.

This station, which was established March 26, 1890, discontinued October 3, 1896, and reestablished August 27, 1903, is located at the county bridge one-half mile from Owyhee post-office and 3 miles above the mouth of the stream.

The data have practical value in connection with irrigation development and have also scientific interest, as they may be used to determine the run-off factors applicable to large arid areas without timber.

Owyhee ditch diverts water 6 miles above the gaging station. A record of the flow of this canal was kept during the irrigating season of 1905 at a point 2 miles below the intake. The maximum diversion during this period was 210 second-feet, in June. There are five waste ways on this canal, the first two being above the gaging station. The natural flow of the river at this point must therefore be obtained by adding the diversion in the canal to the flow obtained at the river gaging station, and subtracting from this sum the amount returning from the first two waste ways.

The entire low-water flow is diverted for irrigation and the flow measured at this point at such times is only seepage water.

During the winter months the gage heights are somewhat affected by ice, but the periods during which the stream is icebound are short, and even at such times approximate records can be obtained. The datum of the gage has not been changed since its installation in 1903. The rating curve is permanent, as the flow is controlled by a riffle 200 yards below the station. Conditions are favorable for good results, and the records are believed to be reliable.

Discharge measurements of Owyhee River at Owyhee, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 25	I. E. Oakes	288	1,330	6.30	4,510
1908. May 28	H. D. McGlashan	277	449	3.34	579

Daily gage height, in feet, of Owyhee River at Owyhee, Oreg., for 1907 and 1908.

[Gilder Watson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.89	3.70	6.55	6.80	5.65	4.25	4.00	2.50	2.00	2.58	2.85	2.90
2	2.90	3.55	6.25	7.40	5.60	4.20	3.95	2.50	1.95	2.55	2.85	2.90
3	2.95	3.33	6.15	7.10	5.50	4.15	3.85	2.48	1.95	2.55	2.85	2.90
4	2.95	5.33	6.05	7.00	5.40	4.10	3.77	2.45	1.95	2.52	2.85	2.90
5	2.95	7.40	6.00	6.90	5.35	4.00	3.70	2.45	2.00	2.50	2.88	2.90
6	3.00	10.32	6.00	6.80	5.25	3.95	3.60	2.42	2.15	2.50	2.88	2.90
7	3.05	10.90	5.95	6.90	5.15	3.90	3.50	3.42	2.20	2.50	2.88	2.90
8	3.05	9.32	5.88	8.64	5.10	3.85	3.44	2.40	2.20	2.50	2.90	2.90
9	3.07	8.25	6.00	8.25	5.00	4.00	3.40	2.38	2.23	2.50	2.90	2.90
10	3.07	7.52	5.90	7.90	4.92	4.20	3.36	2.35	2.25	2.50	2.90	2.90
11	3.10	7.00	5.70	7.40	4.88	4.30	3.29	2.33	2.30	2.50	2.92	2.90
12	3.08	6.80	5.50	7.25	4.81	4.40	3.25	2.30	2.35	2.50	2.95	2.90
13	3.09	6.30	5.35	7.00	4.78	4.50	3.20	2.25	2.38	2.50	2.98	2.90
14	3.05	6.25	5.15	7.50	4.75	4.40	3.14	2.25	2.40	2.50	2.98	2.90
15	3.00	6.10	5.00	7.40	4.73	4.10	3.12	2.20	2.38	2.50	3.00	2.90
16	2.98	6.00	4.85	7.30	4.70	4.15	3.10	2.15	2.38	2.50	3.01	2.90
17	2.95	6.10	4.85	7.20	4.70	4.25	3.05	2.10	2.35	2.50	3.00	2.90
18	2.93	6.20	5.05	7.10	4.70	4.40	3.00	2.10	2.33	2.50	2.95	2.90
19	2.90	6.30	6.65	7.00	4.70	4.50	2.95	2.10	2.30	2.50	2.95	2.90
20	2.95	6.30	9.15	6.90	4.69	4.50	2.90	2.07	2.30	2.50	2.90	2.90
21	3.00	6.40	9.40	6.79	4.68	4.45	3.30	2.07	2.32	2.50	2.90	2.90
22	2.95	6.20	9.18	6.60	4.65	4.40	3.20	2.07	2.35	2.50	2.90	2.90
23	3.00	6.25	9.42	6.50	4.64	4.30	3.12	2.05	2.40	2.55	2.90	2.90
24	3.05	6.20	9.00	6.45	4.62	4.25	3.00	2.05	2.50	2.55	2.90	2.90
25	3.00	6.20	8.45	6.33	4.60	4.18	2.90	2.05	2.52	2.60	2.90	2.95
26	3.00	6.15	8.00	6.25	4.55	4.10	2.82	2.02	2.55	2.60	2.90	2.95
27	3.00	6.15	7.80	6.10	4.50	4.15	2.79	2.00	2.58	2.55	2.90	3.00
28	3.00	6.00	7.40	6.05	4.45	4.10	2.70	2.00	2.60	2.65	2.90	3.00
29	3.10	.....	7.00	5.95	4.40	4.10	2.65	2.00	2.60	2.70	2.90	.....
30	3.40	.....	6.85	5.85	4.35	4.05	2.60	2.00	2.58	2.75	2.90	.....
31	3.33	.....	6.80	.....	4.30	.....	2.50	2.02	.....	2.80	.....	.....
1908.												
1	.....	3.25	3.05	3.65	3.3	3.0	3.6	2.15	.....	2.39	2.7	2.6
2	3.2	3.25	3.05	3.55	3.3	3.0	3.55	2.15	2.03	2.38	2.7	2.6
3	3.2	3.25	3.2	3.45	3.25	3.0	3.5	2.15	2.03	2.35	2.72	2.6
4	3.2	3.25	3.4	3.35	3.25	3.0	3.35	2.15	2.03	2.3	2.73	2.6
5	3.2	3.25	3.4	3.35	3.25	3.0	3.2	2.15	2.03	2.3	2.73	2.6
6	3.25	3.15	3.35	3.35	3.25	4.6	3.1	2.1	2.05	2.3	2.73	2.6
7	3.15	3.1	3.35	3.35	3.2	5.6	3.0	2.1	2.05	2.3	2.75	2.58
8	3.15	3.1	3.3	3.35	3.2	6.1	2.85	2.1	2.05	2.3	2.73	2.58
9	3.15	3.05	3.3	3.35	3.15	5.6	2.71	2.1	2.05	2.3	2.72	2.58
10	3.15	3.05	3.3	3.3	3.15	5.3	2.7	2.05	2.1	2.3	2.7	2.55
11	3.2	3.05	3.3	3.3	3.1	5.1	2.65	2.05	2.1	2.3	2.7	2.52
12	3.15	3.05	3.25	3.3	3.05	5.05	2.65	2.05	2.1	2.32	2.7	2.52
13	3.15	3.05	3.25	3.3	3.05	5.05	2.65	2.05	2.1	2.38	2.7	2.52
14	3.15	3.05	3.25	3.35	3.05	5.0	2.7	2.03	2.1	2.4	2.7	2.55
15	3.15	3.0	3.35	3.4	3.05	4.9	3.60	2.0	2.1	2.44	2.65	2.57
16	3.2	3.0	3.5	3.4	3.05	4.85	3.0	2.0	2.1	2.48	2.65	[a] 3.25
17	3.15	3.0	3.95	3.45	3.05	4.8	2.9	2.0	2.1	2.5	2.65	[b] 3.3
18	3.15	3.0	6.25	3.5	3.05	4.8	2.6	2.0	2.1	2.5	2.65	3.4
19	3.15	3.0	5.65	3.5	3.05	4.7	2.55	2.02	2.15	2.55	2.65	3.5
20	3.15	3.0	5.3	3.58	3.1	4.7	2.48	2.03	2.2	2.55	2.65	3.52
21	3.2	2.95	5.0	3.55	3.05	4.7	2.4	2.05	2.42	2.55	2.65	3.52
22	3.15	2.95	4.6	3.55	3.05	4.6	2.35	2.05	2.42	2.58	2.65	3.55
23	3.15	2.95	4.35	3.5	3.05	4.4	2.3	2.05	2.42	2.62	2.65	3.55
24	3.15	2.95	4.15	3.4	3.05	4.25	2.25	2.05	2.42	2.62	2.65	3.58
25	3.15	3.0	4.05	3.4	3.05	4.1	2.25	2.05	2.42	2.63	2.65	3.58
26	3.2	2.95	4.05	3.35	3.0	4.05	2.25	2.03	3.42	2.63	2.65	3.6
27	3.15	2.95	3.95	3.35	2.95	4.0	2.25	2.03	2.42	2.65	2.65	3.6
28	3.15	2.95	3.9	3.35	3.35	3.9	2.25	.....	2.45	2.65	2.65	3.58
29	3.15	2.95	3.85	3.35	3.35	3.8	2.2	.....	2.4	2.68	2.65	3.55
30	3.2	.....	3.8	3.3	3.05	3.65	2.2	.....	2.4	2.7	2.65	3.52
31	3.2	.....	3.7	.....	3.0	.....	2.15	.....	.....	2.7	.....	3.5

[a] Water turned out of Owyhee canal caused rise in river.
[b] The river began to freeze December 17, and was frozen over December 22 to 31.

Rating table for Owyhee River at Owyhee, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	15	3.50	680	5.20	2,540	8.40	9,890
2.00	25	3.60	755	5.40	2,860	8.60	10,450
2.10	35	3.70	830	5.60	3,210	8.80	11,010
2.20	50	3.80	910	5.80	3,580	9.00	11,570
2.30	70	3.90	995	6.00	3,960	9.20	12,150
2.40	95	4.00	1,080	6.20	4,360	9.40	12,730
2.50	125	4.10	1,170	6.40	4,780	9.60	13,310
2.60	160	4.20	1,270	6.60	5,220	9.80	13,900
2.70	200	4.30	1,370	6.80	5,680	10.00	14,500
2.80	245	4.40	1,480	7.00	6,160	10.20	15,100
2.90	295	4.50	1,590	7.20	6,660	10.40	15,700
3.00	350	4.60	1,710	7.40	7,180	10.60	16,300
3.10	410	4.70	1,830	7.60	7,700	10.80	16,900
3.20	475	4.80	1,960	7.80	8,240	11.00	17,500
3.30	540	4.90	2,100	8.00	8,780		
3.40	610	5.00	2,240	8.20	9,330		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 22 discharge measurements made during 1905–1908 and earlier measurements at medium and high stages, and is fairly well defined for 1907–8.

Monthly discharge of Owyhee River at Owyhee, Oreg., for 1907 and 1908.

[Drainage area, 9,880 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	610	290	366	0.037	0.04	22,500	B.
February	17,200	561	5,560	.563	.59	309,000	A.
March	12,800	2,030	5,800	.587	.68	357,000	A.
April	10,600	3,680	6,130	.620	.69	365,000	A.
May	3,300	1,370	2,060	.209	.24	127,000	A.
June	1,590	952	1,280	.130	.14	76,200	A.
July	1,080	125	498	.050	.06	30,600	A.
August	125	25	60.1	.0061	.01	3,700	B.
September	160	20	82.1	.0083	.01	4,890	B.
October	245	125	142	.014	.02	8,730	B.
November	356	270	302	.031	.03	18,000	B.
December	425	295	310	.031	.04	19,100	B.
The year	17,200	20	1,880	.191	2.55	1,340,000	
1908.							
January	508	442	455	.046	.05	28,000	B.
February	508	322	383	.039	.04	22,000	B.
March	4,460	380	1,080	.109	.13	66,400	A.
April	792	540	616	.062	.07	36,700	A.
May	575	322	428	.043	.05	26,300	A.
June	4,160	350	1,670	.169	.19	99,400	A.
July	755	42	254	.026	.03	15,600	B.
August	42	25	31.3	.0032	.004	1,920	B.
September	110	28	55.8	.0056	.01	3,320	B.
October	200	70	121	.012	.01	7,440	B.
November	222	180	193	.020	.02	11,500	B.
December	508	132	335	.034	.04	20,600	C.
The year	4,460	25	468	.047	.64	339,000	

BOISE RIVER BASIN.

DESCRIPTION.

Boise River rises in the western part of Blaine County and flows westward across Elmore, Ada, and Caldwell counties to its junction with Snake River. Its drainage area is mountainous and well wooded.

BOISE RIVER NEAR HIGHLAND, IDAHO.

This station was established July 27, 1905, to replace the Boise station. It is located 2 miles below the mouth of Moores Creek, 3 miles southwest of Highland post-office, about 8 miles above the old Boise station, and 15 miles east of Boise, the nearest railroad point.

The object of the station is to determine the amount of flood waters available. The records have proved to be very valuable in connection with the distribution of the low-water flow, which is all used for irrigation. Moores Creek enters the river 2 miles above the gaging station; no tributaries come in below. There are no diversions above the station.

The gage heights are somewhat affected by ice during the winter months, and the daily flow may also be affected by flushing during the logging season.

The gage datum has remained unchanged during 1908.

The cross section is permanent and a good rating curve has been obtained. The records may be considered very reliable.

Discharge measurements of Boise River near Highland, Idaho, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 21	E. C. La Rue	241	2,030	11.90	12,200
April 16	do	252	2,380	13.20	16,000
June 3	La Rue and Williams	236	1,930	11.30	12,500
June 29	A. D. Williams	235	1,630	9.95	9,250
July 16	do	235	990	7.25	4,820
August 2	La Rue and Williams	213	584	5.55	2,520
August 12	A. D. Williams	205	448	4.65	1,690
August 30	do	187	372	4.15	1,240
September 25	La Rue and Williams	180	295	3.65	945
1908.					
February 19	A. D. Williams	182	297	3.65	960
May 11[a]	do	233	1,280	8.65	6,040
July 13	Hoyt and La Rue	216	754	6.28	3,440
September 19	E. A. Porter	185	339	3.90	1,260
September 25[b]	do	170	266	3.50	880

[a] Wind upstream. [b] Strong wind downstream.

Daily gage height, in feet, of Boise River near Highland, Idaho, for 1907 and 1908.

[Mrs. Mary Kunzi, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	.....	6.9	8.9	10.6	11.05	9.65	5.7	4.1	.....	3.85	3.7
2	.....	.....	6.4	9.0	10.6	11.3	9.5	5.55	4.15	.....	3.8	3.55
3	.....	.....	6.4	9.2	10.6	11.3	9.6	5.5	4.15	.....	3.75	3.5
4	.....	.....	6.35	9.25	10.65	11.15	9.8	5.4	4.2	.....	3.75	3.6
5	.....	.....	6.3	9.4	10.65	10.75	9.65	5.2	4.1	.....	3.7	3.7
6	.....	.....	7.55	9.45	10.65	10.65	9.0	5.1	4.15	.....	3.65	3.75
7	.....	.....	7.4	9.55	10.85	10.85	8.0	5.0	4.05	.....	3.7	3.8
8	.....	6.8	7.5	10.0	11.05	10.55	8.15	4.95	3.95	.....	3.7	3.95
9	.....	6.8	7.45	10.5	11.15	10.35	8.4	4.85	3.9	3.7	3.65	3.75
10	.....	6.7	7.3	11.0	11.25	10.2	8.5	4.8	3.85	3.75	3.65	3.65
11	.....	6.4	7.2	11.0	11.45	10.05	8.3	4.75	3.9	3.65	3.6	3.8
12	.....	6.3	7.1	12.0	10.8	9.85	8.15	4.65	3.95	3.6	3.55	3.8
13	.....	6.25	6.95	12.5	10.75	9.85	8.15	4.6	3.9	3.75	3.6	3.85
14	.....	6.2	6.75	13.0	10.25	9.6	7.65	4.5	3.85	3.95	3.65	3.8
15	.....	6.25	6.8	13.7	10.05	9.2	7.45	4.45	3.85	3.75	3.65	3.65
16	.....	6.25	6.9	13.2	10.35	8.8	7.2	4.4	3.8	3.75	3.6	3.55
17	.....	6.3	6.8	12.45	10.75	8.2	7.05	4.35	3.8	3.7	3.65	.....
18	.....	6.25	8.7	12.0	11.45	7.85	6.9	4.3	3.75	3.7	3.7	.....
19	.....	6.25	11.5	11.35	11.9	7.9	6.9	4.25	3.8	3.7	3.55	.....
20	.....	6.2	11.6	10.85	11.85	8.1	6.95	4.25	3.75	3.7	3.6	.....
21	.....	6.25	11.9	10.9	11.3	8.6	6.8	4.2	3.7	3.7	3.75	.....
22	.....	6.2	11.1	10.9	11.05	9.0	6.7	4.1	3.75	3.7	3.65	4.05
23	.....	6.25	10.25	11.45	10.65	8.75	6.6	4.2	3.7	3.7	3.7	4.05
24	.....	6.4	9.8	11.45	10.55	8.3	6.45	4.25	3.7	3.7	3.75	4.05
25	.....	6.5	9.5	11.45	10.15	8.3	6.35	4.35	3.65	3.65	3.85	4.15
26	.....	6.7	9.05	11.25	10.0	9.0	6.2	4.35	3.65	3.65	3.9	4.05
27	.....	7.2	8.75	11.15	9.8	9.1	6.15	4.35	3.6	3.65	3.85	4.3
28	.....	7.25	8.6	10.95	9.75	9.5	6.25	4.35	3.5	3.75	3.7	4.05
29	.....	.....	8.5	10.85	9.75	9.95	6.2	4.25	3.6	3.75	3.7	4.0
30	.....	.....	8.4	10.85	10.55	9.8	6.0	4.15	3.6	3.75	3.75	3.8
31	.....	.....	8.35	.....	10.85	.....	5.85	4.1	.....	3.85	.....	3.95
1908.[a]												
1	4.05	.....	4.2	5.25	8.8	6.75	7.75	4.1	3.4	3.4	3.8	3.6
2	3.95	.....	4.1	5.25	9.15	6.6	7.8	4.2	3.35	3.4	3.8	3.5
3	3.95	4.15	3.95	5.35	8.9	6.7	7.85	3.85	3.3	3.4	3.8	3.6
4	3.9	4.15	3.85	5.55	9.15	6.9	7.0	4.1	3.3	3.45	3.75	3.7
5	3.85	4.05	4.0	6.1	8.9	6.75	7.7	3.85	3.25	3.45	3.6	3.6
6	3.75	3.95	3.95	5.9	9.25	6.65	7.35	3.9	3.3	3.45	3.6	3.5
7	3.65	3.95	3.85	5.8	9.8	6.7	7.0	3.95	3.35	3.4	3.6	3.5
8	3.75	3.9	3.75	5.9	10.1	7.0	7.0	3.85	3.6	3.4	3.65	3.6
9	4.0	3.9	3.8	6.1	9.7	7.25	6.95	3.9	3.5	3.35	3.6	3.6
10	3.9	3.85	3.8	7.5	9.2	7.7	6.8	3.55	3.4	3.35	3.6	3.55
11	3.85	3.8	3.9	7.75	8.5	8.15	6.7	3.6	3.45	3.35	3.6	3.45
12	4.0	3.8	4.1	8.45	8.2	9.0	6.4	3.7	3.5	3.35	3.65	3.5
13	3.9	3.7	4.3	9.5	8.1	9.5	6.3	3.5	3.45	3.4	3.65	3.65
14	4.05	3.7	4.55	9.1	7.85	9.3	6.5	3.55	3.4	3.45	3.55	3.3
15	4.15	3.75	5.8	9.0	7.75	7.1	6.7	3.95	3.35	5.55	3.5	3.0
16	3.95	3.9	6.7	9.55	7.6	7.5	6.0	3.7	3.5	5.0	3.2	.....
17	3.95	3.85	6.6	9.15	7.45	9.4	5.7	3.75	3.6	4.3	3.4	.....
18	3.9	3.85	7.35	9.1	7.3	9.0	5.4	3.6	4.0	4.1	3.6	.....
19	3.9	3.75	6.8	9.6	7.3	8.5	5.3	3.6	3.8	3.95	3.6	.....
20	4.15	3.8	6.2	10.0	7.2	7.9	5.15	3.55	3.65	4.0	3.7	.....
21	4.0	3.75	6.0	10.25	7.0	7.8	5.1	3.6	3.6	4.2	3.8	.....
22	3.9	3.8	5.85	10.5	6.85	7.3	5.0	3.6	3.55	3.6	3.9	.....
23	3.7	3.85	5.8	10.15	6.7	7.0	5.0	3.65	3.5	3.8	3.75	3.7
24	3.85	4.0	5.9	9.65	6.65	6.9	4.8	3.6	3.5	3.75	3.75	3.75
25	4.05	4.05	6.15	9.1	6.95	6.85	4.75	3.45	3.5	3.75	3.65	3.5
26	4.05	4.1	6.0	8.9	7.15	7.4	4.6	3.45	3.55	3.75	3.5	3.5
27	3.95	4.15	5.95	8.65	7.0	7.9	4.45	3.4	3.6	3.75	3.4	3.7
28	3.9	4.25	5.75	8.4	6.9	7.65	4.4	3.4	3.5	3.75	3.2	3.8
29	3.85	4.3	5.6	8.3	6.8	7.45	4.3	3.4	3.5	3.75	3.0	3.6
30	3.95	.....	6.0	8.4	6.9	7.6	4.25	3.4	3.45	3.75	3.55	3.5
31	3.75	.....	5.65	.....	6.85	.....	4.1	3.4	.....	3.75	.....	3.2

[a] There was slush ice January 12 to 14, 22 to 23, February 13, 14, 21, and 22, and December 11, 15, 29, and 30; gage height probably not affected. River frozen over February 1 and 2 and December 16 to 22.

Rating tables for Boise River near Highland, Idaho.

JANUARY 1, 1906, TO APRIL 9, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	560	4.50	1,430	6.00	2,620	8.00	5,180
3.10	600	4.60	1,470	6.10	2,730	8.20	5,470
3.20	650	4.70	1,510	6.20	2,840	8.40	5,770
3.30	700	4.80	1,560	6.30	2,950	8.60	6,070
3.40	750	4.90	1,620	6.40	3,060	8.80	6,370
3.50	810	5.00	1,700	6.50	3,180	9.00	6,670
3.60	880	5.10	1,780	6.60	3,300	9.20	6,970
3.70	960	5.20	1,860	6.70	3,420	9.40	7,270
3.80	1,060	5.30	1,940	6.80	3,540	9.60	7,590
3.90	1,160	5.40	2,020	6.90	3,670	9.80	7,910
4.00	1,240	5.50	2,110	7.00	3,800	10.00	8,230
4.10	1,280	5.60	2,200	7.20	4,060	11.00	9,830
4.20	1,310	5.70	2,300	7.40	4,340	12.00	11,430
4.30	1,350	5.80	2,400	7.60	4,620		
4.40	1,390	5.90	2,510	7.80	4,900		

APRIL 10, 1907, TO APRIL 22, 1908.[b]

3.00	560	4.50	1,520	6.00	3,020	8.00	6,000
3.10	600	4.60	1,600	6.10	3,140	8.20	6,3[illegible]0
3.20	650	4.70	1,680	6.20	3,270	8.40	6,690
3.30	700	4.80	1,760	6.30	3,400	8.60	7,050
3.40	750	4.90	1,850	6.40	3,530	8.80	7,410
3.50	810	5.00	1,940	6.50	3,670	9.00	7,770
3.60	870	5.10	2,040	6.60	3,810	9.20	8,130
3.70	930	5.20	2,140	6.70	3,950	9.40	8,490
3.80	1,000	5.30	2,240	6.80	4,100	9.60	8,850
3.90	1,070	5.40	2,340	6.90	4,250	9.80	9,220
4.00	1,140	5.50	2,450	7.00	4,400	10.00	9,600
4.10	1,210	5.60	2,560	7.20	4,700	11.00	11,600
4.20	1,280	5.70	2,670	7.40	5,020	12.00	13,600
4.30	1,360	5.80	2,780	7.60	5,340	13.00	15,600
4.40	1,440	5.90	2,900	7.80	5,660	14.00	17,600

APRIL 23, 1908, TO DECEMBER 31, 1908.[c]

3.00	650	4.00	1,260	5.00	2,030	6.00	3,070
3.10	700	4.10	1,330	5.10	2,120	6.10	3,190
3.20	755	4.20	1,400	5.20	2,220	6.20	3,310
3.30	810	4.30	1,470	5.30	2,320	6.30	3,430
3.40	870	4.40	1,540	5.40	2,420	6.40	3,560
3.50	930	4.50	1,610	5.50	2,520	6.50	3,690
3.60	990	4.60	1,690	5.60	2,630	6.60	3,820
3.70	1,050	4.70	1,770	5.70	2,740	6.70	3,960
3.80	1,120	4.80	1,850	5.80	2,850	6.80	4,100
3.90	1,190	4.90	1,940	5.90	2,960		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 16 discharge measurements made during 1905–1907 and is well defined between gage heights 3.00 feet and 12.00 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 14 discharge measurements made during 1906–1908, and is well defined between gage heights 3.10 feet and 13.20 feet. Below gage height 3.50 feet it is the same as the previous table.

[c] This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908 and earlier high-water measurements, and is fairly well defined. Above gage height 6.80 feet it is the same as the previous table.

Monthly discharge of Boise River near Highland, Idaho, for 1907 and 1908.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.				Run-off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
1907.							
February 8–28	4,130	2,840	3,150	1.21	0.94	131,000	A.
March	11,270	2,950	5,580	2.14	2.47	343,000	A.
April	17,000	6,520	11,200	4.29	4.79	666,000	A.
May	13,400	9,125	11,000	4.21	4.85	676,000	A.
June	12,200	5,745	8,910	3.41	3.80	530,000	A.
July	9,220	2,840	5,410	2.07	2.39	333,000	A.
August	2,670	1,210	1,640	.628	.72	101,000	A.
September	1,280	810	1,030	.395	.44	61,300	B.
October	1,105	870	932	.357	.41	57,300	B.
November	1,070	840	933	.357	.40	55,500	B.
December	1,360	810	1,030	.395	.46	63,300	B.
The period						3,020,000	
1908.							
January	1,240	900	1,080	.414	.48	66,400	B.
February	1,360	930	1,080	.414	.45	62,100	B.
March	4,940	965	2,280	.874	1.01	140,000	A.
April	10,600	2,190	6,380	2.44	2.72	380,000	A.
May	9,800	3,880	5,970	2.29	2.64	367,000	A.
June	8,670	3,820	5,410	2.07	2.31	322,000	A.
July	5,740	1,330	3,200	1.23	1.42	197,000	A.
August	1,400	870	1,050	.402	.46	64,600	B.
September	1,260	782	925	.354	.40	55,000	B.
October	2,580	840	1,100	.421	.49	67,600	B.
November	1,190	650	988	.379	.42	58,800	B.
December	1,120	650	943	.361	.42	58,800	B.
The year	10,600	650	2,530	.971	13.22	1,840,000	

SEEPAGE INVESTIGATIONS ON BOISE RIVER.

Investigation of the amount of seepage water returning to Boise River between the mouth of the canyon 8 miles above Boise and the highway bridge 1½ miles above Caldwell were made August 5–11, 1907, and September 19–25, 1908. The work was done on foot by following the river channel and keeping close to the water's edge, so that the discharge of every canal and natural stream could be obtained. The flow of large streams was measured and that of small ones was estimated.

Between the canyon and the Highland gaging station, 8 miles upstream, the river flows through a narrow, rocky gorge, and there is practically no loss or gain.

The net seepage is the difference between the discharge of the river at the upper point plus all the tributaries between the two points of measurement and the discharge of the river at the lower point plus all the diverted water between the two points in question.

RESULTS IN 1907.

On August 5, 1907, the gage at Highland read 5.2 feet, showing a discharge, according to the rating table, of 2,150 second-feet; on August 12 the gaging showed 1,689 second-feet, with gage at 4.65 feet; these figures indicate a decrease of 461 second-feet during the period covered by the study. By taking 1,920 second-feet as the

discharge at the mouth of the canyon, the necessary allowance is made for the decrease in discharge.

The summer of 1907 was one of the wettest ever known to the irrigators in the Boise Valley, and the discharge was almost double that for the same period during previous years.

The results may be tabulated as follows:

Discharge of Boise River at upper point plus tributaries.

Date.	Stream.	Locality of heading or place of measurement.	Discharge.
1907.			*Sec.-ft.*
August 5	Waste from spring	Between 9th street and Broadway bridge	0.8
Do	Waste from slough	do	.7
Do	Waste from canals and sloughs.	Between Broadway bridge and Ridenbaugh canal heading.	2.3
August 6	Waste from Rossi canal	One-fourth mile below 9th street bridge	32.5
Do	do	At Oregon Short Line Railway bridge	9.0
Do	do	At wagon bridge	30.4
Do	Waste	Below wagon bridge	.7
Do	do	One-half mile below soldiers' home	1.8
Do	do	1 mile below soldiers' home	1.2
Do	do	From Settlers canal	.6
August 7	do	2 miles below soldiers' home	4.9
Do	do	At Eagle Island bridge	.8
Do	do	1 mile below Eagle Island bridge	.7
Do	do	From Eureka canal	.8
Do	do	From Phyllis canal	.5
August 8	do	From Eureka canal	6.1
Do	Fivemile Creek		16.8
August 9	Waste	1 mile above Interurban Railway bridge	1.8
Do	do	One-half mile above Interurban Railway bridge	.3
Do	do	From Foot's ditch	.4
Do	do	From Canyon County ditch	.4
Do	Willow Creek	At Middleton	.8
August 10	Waste	3 miles below Star	7.3
Do	Paines Gulch	2 miles below Eagle	.3
Do	Dry Creek	1½ miles below Eagle	2.8
Do	Waste	1 mile below Boise	1.0
Do	Sewer	One-half mile above soldiers' home	10.0
August 12	Boise River	At mouth of canyon (8 miles above Boise)	1,920.0
Total			2,365.7

Discharge of Boise River at the lower point plus all diversions.

Date.	Stream.	Locality of heading or place of measurement.	Discharge.
1907.			*Sec.-ft.*
August 9	Boise River	Lower point of measurement 1½ miles from Caldwell.	460.3
August 5	New York canal	Wagon bridge one-half mile below Barber dam	213.5
Do	Ridenbaugh canal	Wagon bridge below waste ways	465.0
Do	Keogh and Rein ditch.	At wheel lift	.8
Do	Paynne ditch	Below waste way	7.3
Do	Rossi canal	do	224.2
August 6	Small ditch	Three-fourths mile below railway bridge	10.3
Do	do	5 miles below railway bridge	.8
Do	do	1 mile above Island bridge	8.8
August 7	Phyllis canal	Below waste way	215.1
Do	Eureka canal	do	18.7
Do	Small ditch	1 mile below Star	.8
August 8	Caldwell Highline canal.	At wagon bridge below upper waste way	78.5
August 9	Riverside canal	Wagon bridge 1½ miles above Caldwell	157.8
Do	Sebree canal	do	229.6
Do	Small ditch	2 miles above Interurban Railway bridge	5.5
Do	Allison Creek	At Star	.8
August 10	Middleton ditch	At heading	22.9
Do	Ballantyne canal	1 mile below	8.2
Do	Settlers canal	Below waste way	34.3
Do	Dry Creek canal	do	25.7
Do	Little Union ditch	do	2.5
Do	Boise Valley ditch	do	20.9
Do	Farmers Union ditch	do	113.2
August 5	Perrault ditch	Below all waste	24.5
Do	Boise City ditch	do	50.2
Total			2,400.2

RESULTS IN 1908.

On September 19, 1908, a gaging was made at the Highland station. The gage was at a height of 3.90 feet, giving a discharge of 1,255 second-feet. On September 25 the gage had dropped to 3.5 feet and the result of gaging gave a discharge of 880 second-feet. The average of the two gagings was 1,068 second-feet, which was used as the average discharge at the mouth of the canyon, which is about 8 miles below the gaging station.

The results, tabulated, are as follows:

Discharge of Boise River at upper point plus tributaries.

Date.	Stream.	Locality of heading or place of measurement.	Discharge.
1908.			*Sec.-ft.*
September 20	Waste from spring	One-half mile above Ninth street bridge	1.3
Do	Waste from slough	100 feet above Broadway bridge	1.7
Do	Waste from Ridenbaugh canal.	1 mile above Rossi canal	1.2
Do	Waste from Ridenbaugh and Bubb canals.	Near ranch house	16.9
Do	Waste from Russell slough.	At Broadway bridge	43.0
Do	Waste from Front ditch.	200 feet west of Broadway street	30.8
September 21	Waste from Rossi canal.	2,000 feet below Ninth street bridge	11.7
Do	do	3,000 feet below Ninth street bridge	0.8
Do	do	One-fourth mile above Oregon Short Line Railway bridge.	42.5
Do	Waste from ditches and Rossi canal.	Near Chinese ranch	8.0
Do	Waste from Thurman canal.	Three-fourths mile below Oregon Short Line Railway bridge.	2.0
Do	do	Near farmhouse below Oregon Short Line Railway bridge.	33.2
Do	do	At Nettle ranch	3.0
Do	Waste from canals	At old grist mill	6.3
Do	do	In fields below old grist mill	3.0
Do	do	In lower end of field	2.0
Do	do	At head of Eagle Island	19.3
Do	Waste from ditch	100 feet above Eagle bridge	1.7
Do	Waste from slough	2 miles below Eagle bridge	4.5
Do	Waste from New York canal.	Near head of Phyllis canal	4.5
September 22	Waste from Highland canal.	Below head of canal	4.8
Do	do	At Star bridge	4.0
Do	do	Below Star bridge	.8
Do	Waste from canal	5 miles above Caldwell	35.0
Do	do	One-fourth mile east of railroad tracks	2.5
Do	do	One-fourth mile west of railroad tracks	1.8
Do	Waste from Manson Creek.	At King's ranch	8.7
Do	Waste from Phyllis canal.	Below head of canal	8.0
Do	Waste from Five-mile Creek.	One-fourth mile below Star bridge	11.4
Do	Waste from canals	Between Manson Creek and Caldwell bridge	12.0
Do	do	Between Caldwell bridge and Middleton	7.0
September 23	Willow Creek	At Middleton	95.0
Do	Waste from canals	Just east of Middleton	2.6
Do	Dry Creek	Wagon road	.9
Do	Slough	East of Eagle	6.9
September 24	Boise city sewer	At outlet	10.0
Do	Waste from canals	One-half mile above sewer outlet	6.1
Do	do	Five-eighths mile above sewer outlet	1.2
September 19–September 25	Boise River	At mouth of canyon above Boise	1,068.0
Total			1,524.1

Discharge of Boise River at lower point plus all diversions.

Date.	Stream.	Locality of heading or place of measurement.	Discharge.
1908.			*Sec.-ft.*
September 20	Rossi canal	At head, below waste way	61.3
Do	Bubb or Gallagher canal.	At head, above all waste way	12.5
Do	Keough flume	At Ridenbaugh canal	.6
Do	Ridenbaugh canal	At wagon bridge	386.1
Do	New York canal	At wagon bridge (gage=2.3 feet)	190.4
Do	Perrault canal	At railway crossing	101.0
Do	Boise City ditch	do	8.0
September 21	Settler canal	At wagon bridge	30.9
Do	David canal	Below Oregon Short Line Railway bridge	.0
Do	Thurman canal	At head	30.8
September 22	Phyllis canal	At fourth wagon bridge	132.3
Do	Highland canal	At first wagon bridge	52.8
Do	Eureka canal	At head	.0
Do	Low slough	do	3.6
September 23	Canyon ditch	1 mile east of Middleton wagon bridge	65.7
Do	Mill slough	300 feet north of road near head	43.7
Do	Mill canal	At wagon bridge	38.8
Do	Ballantyne canal	do	3.8
Do	Dry Creek ditch	At Frank's ranch	5.1
September 24	Farmers Union No. 1 and No. 2.	At rear of soldiers' home	40.8
September 22	Boise River	At Caldwell Canyon	361.8
Total			1,570.0

SEEPAGE GAINS IN BOISE RIVER.

Investigations similar to the above were made during 1898, 1901, 1902, 1903, 1905, 1906, 1907, and the results were as follows:

1898, August 24–September 2:

	Sec.-feet.	Sec.-feet.
Amount taken out by canals		1,160.0
Amount in river above canals	734.0	
Amount of measured return waters	197.0	
	931.0	
Amount in river at Caldwell station	31.0	
Difference		900.0
Gain by seepage in 34 miles		260.0

1901, August 13–17:

Discharge Boise River above New York canal heading		821.0
Discharge Boise River at Caldwell Canyon	73.3	
Amount of measured return water		131.0
Amount taken out by canals	1,140.1	
Gain by seepage in 34 miles		261.4
	1,213.4	1,213.4

1902, August 11–15:

Discharge Boise River at upper point		924.5
Discharge Boise River at lower point	1.5	
Amount of measured return waters		174.4
Amount taken out by canals	1,309.0	
Gain by seepage in 34 miles		211.6
	1,310.5	1,310.5

	Sec.-feet.	Sec.-feet.
1903, October 24–29:		
Discharge of Boise River at upper point		771.6
Discharge of Boise River at lower point	619.4	
Amount of measured return waters		362.6
Amount taken out by canals	654.4	
Gain by seepage in 34 miles		[a] 139.6
	1,273.8	1,273.8
1905, October 2–7:		
Discharge Boise River at upper point		602.0
Discharge Boise River at lower point	106.6	
Amount of measured return waters		82.7
Amount taken out by canals	601.5	
Gain by seepage in 34 miles		23.4
	708.1	708.1
1906, October 9–12:		
Discharge Boise River at upper point		650.0
Discharge Boise River at lower point	95.1	
Amount of measured return water		218.9
Amount taken out by canals	777.9	
Gain by seepage in 34 miles		4.1
	873.0	873.0
1907, August 2–10:		
Discharge Boise River at upper point		1,920.0
Discharge Boise River at lower point	460.3	
Amount of measured return water		445.7
Amount taken out by canals	1,939.9	
Gain by seepage in 34 miles		34.5
	2,400.2	2,400.2
1908, September 19–25:		
Discharge Boise River at upper point		1,068.0
Discharge Boise River at lower point	361.8	
Amount of measured return water		456.1
Amount taken out by canals	1,208.2	
Gain by seepage in 34 miles		45.9
	1,570.0	1,570.0

PAYETTE RIVER BASIN.

DESCRIPTION.

Payette River rises in the eastern part of Boise County, Idaho, and flows in a generally westerly direction to its junction with Snake River near Payette, Idaho. It is about 110 miles long and drains an area comprising approximately 3,565 square miles. Its basin is well wooded and mountainous and is similar to that of Boise River.

[a] Mistakes were found in calculation. The result of 255.3 second-feet as published in Water-Supply Paper No. 100 should read 139.6 second-feet.

The principal tributaries of the Payette are its Middle and North forks. The low-water flow of the river is appropriated for irrigation in the valleys below Horseshoe Bend, but more than a million acre-feet of flood water runs to waste each year. Payette Lake, at the head of the North Fork, affords a good storage site, which will be used by the United States Reclamation Service.

NORTH FORK OF PAYETTE RIVER AT LARDO, IDAHO.

The North Fork of Payette River rises in Big Payette Lake, flows southward, and unites with the main stream near Pinehurst.

The gaging station, which was established August 25, 1908, to obtain a record of the amount of water available for storage on Big Payette Lake, is located about one-fourth mile below the lake outlet and the same distance from Lardo, Idaho.

The equipment consists of a vertical staff gage and a cable and car. The discharge can not be computed until more data are available.

Discharge measurements of North Fork of Payette River at Lardo, Idaho, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 25[a]	E. C. La Rue	82	119	2.20	63
October 24	do	66	104	2.54	135

[a] Measured from ferryboat.

Daily gage height, in feet, of North Fork of Payette River at Lardo, Idaho, for 1908.

[Neal Boydstrom, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	2.2	2.0	2.5	2.45	16	2.1	2.4	2.5	2.4
2	2.2	2.0	2.6	2.45	17	2.1	2.4	2.5	2.4
3	2.15	2.0	2.6	2.45	18	2.1	2.5	2.5	2.4
4	2.15	2.0	2.6	2.45	19	2.1	2.5	2.5	2.4
5	2.1	2.0	2.6	2.45	20	2.1	2.5	2.5	2.35
6	2.1	2.0	2.6	2.4	21	2.1	2.5	2.5	2.35
7	2.1	2.0	2.6	2.4	22	2.1	2.5	2.5	2.35
8	2.1	2.0	2.6	2.4	23	2.05	2.5	2.55	2.35
9	2.1	.....	2.5	2.4	24	2.05	2.5	2.55	2.35
10	2.05	.....	2.5	2.4	25	2.05	2.5	2.5	2.35
11	2.05	.....	2.5	2.4	26	2.05	2.5	2.5	2.35
12	2.1	.....	2.5	2.4	27	2.05	2.5	2.5	2.35
13	2.1	.....	2.5	2.45	28	2.0	2.5	2.5	2.35
14	2.1	2.1	2.5	2.45	29	2.0	2.5	2.45	2.35
15	2.1	2.3	2.5	2.45	30	2.0	2.5	2.45	2.35
					31	.....	2.5	.....	2.35

PAYETTE RIVER NEAR HORSESHOE BEND, IDAHO.

This station, which was established February 13, 1906, to determine the total amount of water available for irrigation, is located on the main river, about 10 miles below the junction of the North and South forks, at a point known as Jerusalem, 5 miles above

Horseshoe Bend post-office, Idaho, and about 32 miles from Boise, the most convenient railway point.

There are no tributaries below the gaging station except small creeks, which are dry the greater part of the year. Squaw Creek is the largest of these.

As no water is diverted above the station the records give the total amount of water available from the upper Payette basin.

The gage heights are not affected by ice, but some irregularity of flow is caused by flushing during the logging season in June and July. This, however, only affects the daily discharge and not the monthly run-off.

The gage datum has remained unchanged and the records are good.

Discharge measurements of Payette River near Horseshoe Bend, Idaho, 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 17	A. D. Williams	282	1,270	7.05	6,650
August 1	do	268	844	5.70	3,570
August 31	do	253	356	4.50	1,560
1908.					
May 12	A. D. Williams	285	1,350	7.45	7,250

Daily gage height, in feet, of Payette River near Horseshoe Bend, Idaho, for 1907 and 1908.

[E. R. Sherard, observer.]

Day.	Jan.	Feb	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1			5.4	6.5	7.8	9.65	8.95	5.75	4.55	4.2	4.3	3.9
2			5.3	6.6	7.85	9.8	8.95	5.65	4.55	4.2	4.3	3.9
3			5.2	6.65	7.95	9.95	9.0	5.6	4.55	4.2	4.25	3.85
4			5.35	6.7	8.1	10.2	9.0	5.5	4.55	4.2	4.2	3.8
5			5.45	6.8	8.1	10.25	8.95	5.4	4.5	4.25	4.2	3.9
6			5.5	6.85	9.0	10.3	8.9	5.35	4.5	4.25	4.15	3.9
7			5.55	6.9	9.05	10.45	8.7	5.3	4.5	4.25	4.15	4.0
8			5.6	7.0	9.05	10.4	8.55	5.2	4.5	4.15	4.1	4.0
9			5.65	8.2	9.1	10.0	8.4	5.15	4.45	4.15	4.1	4.1
10			5.65	8.45	9.15	9.8	8.25	5.1	4.45	4.15	4.1	4.1
11			5.6	8.65	9.2	9.65	8.05	5.0	4.45	4.1	4.1	4.2
12			5.5	8.7	9.3	9.45	7.8	5.95	4.4	4.1	4.05	4.2
13			5.35	9.0	9.45	9.4	7.65	5.9	4.4	4.1	4.05	4.2
14			5.3	9.5	9.6	9.25	7.5	5.9	4.4	4.1	4.05	4.2
15			5.2	9.9	9.95	9.0	7.4	5.85	4.4	4.1	4.0	4.2
16			5.15	10.0	10.0	8.8	7.3	5.85	4.35	4.1	4.0	4.2
17		5.05	5.1	9.5	10.0	8.7	7.25	5.8	4.35	4.1	4.0	4.25
18		5.05	7.5	9.3	10.05	8.7	7.2	5.7	4.35	4.1	4.0	4.3
19		5.05	10.2	9.0	10.25	8.75	7.0	5.5	4.3	4.1	4.05	4.3
20		5.0	10.1	8.7	10.1	8.75	6.85	5.25	4.3	4.1	4.05	4.25
21		4.95	9.8	8.3	10.0	8.65	6.75	5.0	4.25	4.1	4.1	4.2
22		5.4	9.1	8.0	9.9	8.6	6.6	4.8	4.25	4.2	4.1	4.2
23		5.85	7.75	8.05	9.9	8.5	6.5	4.75	4.25	4.15	4.2	4.25
24		6.0	7.1	8.1	9.85	8.5	6.35	4.6	4.25	4.1	4.2	4.3
25		5.8	7.2	8.1	9.7	8.4	6.25	4.7	4.25	4.1	4.1	4.4
26		5.75	6.9	8.2	9.55	8.5	6.2	4.7	4.25	4.1	4.1	4.5
27		5.6	6.75	8.3	9.4	8.65	6.1	4.65	4.25	4.1	4.05	4.4
28		5.5	6.55	8.25	9.45	8.75	6.8	4.65	4.25	4.15	4.05	4.25
29			6.4	8.05	9.6	8.9	6.65	4.6	4.25	4.15	4.0	4.2
30			6.3	8.0	9.6	9.0	6.45	4.6	4.25	4.2	4.0	4.2
31			6.2		9.65		6.1	4.6		4.2		4.2

Daily gage height, in feet, of Payette River near Horseshoe Bend, Idaho, for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	4.2	3.9	4.2	4.8	7.35	6.8	7.4	4.6	4.25	4.15	4.35	4.25
2	4.2	3.9	4.2	4.85	7.35	6.6	7.45	4.6	4.25	4.15	4.35	4.2
3	4.2	4.0	4.15	4.9	7.4	6.8	7.45	4.55	4.2	4.15	4.35	4.2
4	4.2	4.0	4.1	4.9	7.5	7.0	7.5	4.5	4.2	4.1	4.4	4.1
5	4.15	4.0	4.0	4.95	7.6	7.0	7.3	4.5	4.2	4.1	4.4	4.1
6	4.1	4.0	4.0	4.95	7.7	6.9	7.15	4.5	4.2	4.1	4.4	4.1
7	4.1	4.0	4.0	4.95	7.75	7.0	7.0	4.45	4.15	4.1	4.4	4.1
8	4.1	4.0	4.0	5.0	7.8	6.7	6.9	4.45	4.15	4.05	4.35	4.1
9	4.05	4.0	4.05	5.2	7.95	7.1	6.75	4.45	4.15	4.05	4.35	4.1
10	4.05	4.1	4.05	5.2	8.0	7.3	6.6	4.4	4.15	4.05	4.35	4.1
11	4.05	4.1	4.1	6.2	7.9	7.4	6.45	4.4	4.1	4.8	4.35	4.1
12	4.1	4.1	4.15	6.6	7.75	7.6	6.3	4.4	4.1	4.95	4.35	4.1
13	4.1	4.0	4.2	7.2	7.5	8.0	6.2	4.4	4.1	5.3	4.35	4.0
14	4.1	4.0	4.4	7.4	7.2	8.0	6.1	4.4	4.1	5.5	4.35	4.0
15	4.1	4.0	5.4	7.6	7.05	7.9	6.05	4.4	4.15	5.0	4.4	4.0
16	4.1	4.0	6.3	7.5	6.9	7.9	6.0	4.4	4.2	4.85	4.4	4.0
17	4.1	4.0	6.8	7.5	6.8	7.85	5.9	4.4	4.7	4.7	4.4	3.95
18	4.1	4.0	6.4	7.4	6.65	7.8	5.8	4.35	4.5	4.6	4.45	3.95
19	4.3	3.95	6.0	7.55	6.6	7.7	5.7	4.35	4.4	4.55	4.45	3.95
20	4.3	3.9	5.6	7.7	6.65	7.7	5.65	4.35	4.3	4.45	4.45	4.0
21	4.2	3.95	5.4	8.0	6.7	7.65	5.6	4.35	4.3	4.4	4.45	4.0
22	4.2	4.0	5.3	8.3	6.75	7.65	5.5	4.35	4.3	4.4	4.45	4.0
23	4.15	4.0	5.3	8.5	6.8	7.6	5.4	4.35	4.25	4.4	4.4	4.0
24	4.1	4.0	5.2	8.6	6.75	7.55	5.35	4.3	4.25	4.35	4.4	4.05
25	4.1	4.05	5.15	8.3	6.7	7.4	5.3	4.3	4.25	4.35	4.4	4.05
26	4.1	4.05	5.1	8.0	6.9	7.4	5.2	4.3	4.15	4.35	4.4	4.05
27	4.1	4.1	5.1	7.75	6.85	7.35	5.1	4.3	4.15	4.35	4.4	4.1
28	4.0	4.15	5.0	7.5	6.85	7.3	4.95	4.3	4.1	4.3	4.35	4.1
29	4.0	4.2	4.9	7.2	6.9	7.2	4.85	4.3	4.1	4.3	4.3	4.1
30	4.0	.....	4.9	7.25	7.0	7.15	4.7	4.25	4.1	4.3	4.3	4.1
31	3.95	.....	4.8	.....	6.95	.....	4.6	4.25	.....	4.3	.....	4.1

[a] There was slush ice for a few days in January, February, and in December; gage heights probably not affected.

Rating table for Payette River near Horseshoe Bend, Idaho, for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	760	5.00	2,250	6.30	4,780	8.20	9,830
3.80	850	5.10	2,420	6.40	5,020	8.40	10,410
3.90	940	5.20	2,590	6.50	5,260	8.60	11,000
4.00	1,030	5.30	2,770	6.60	5,510	8.80	11,600
4.10	1,130	5.40	2,960	6.70	5,760	9.00	12,220
4.20	1,230	5.50	3,150	6.80	6,020	9.20	12,840
4.30	1,330	5.60	3,340	6.90	6,280	9.40	13,480
4.40	1,440	5.70	3,530	7.00	6,540	9.60	14,120
4.50	1,550	5.80	3,720	7.20	7,070	9.80	14,760
4.60	1,670	5.90	3,920	7.40	7,610	10.00	15,420
4.70	1,800	6.00	4,120	7.60	8,150	11.00	18,720
4.80	1,940	6.10	4,330	7.80	8,710		
4.90	2,090	6.20	4,550	8.00	9,270		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 13 discharge measurements made during 1906–1908, and is well defined between gage heights 4.2 feet and 8.2 feet.

Monthly discharge of Payette River near Horseshoe Bend, Idaho, for 1907 and 1908.

[Drainage area, 2,240 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 17–28	4,120	2,170	3,010	1.34	0.60	71,600	A.
March	16,100	2,420	5,550	2.48	2.86	341,000	A.
April	15,400	5,260	9,790	4.37	4.88	583,000	A.
May	16,200	8,710	13,400	5.98	6.89	824,000	A.
June	16,900	10,400	13,100	5.85	6.53	780,000	A.
July	12,200	4,330	7,980	3.56	4.10	491,000	A.
August	4,020	1,670	2,720	1.21	1.40	167,000	A.
September	1,610	1,280	1,420	.634	.71	84,500	A.
October	1,280	1,130	1,180	.527	.61	72,600	A.
November	1,330	1,030	1,130	.504	.56	67,200	A.
December	1,550	850	1,190	.531	.61	73,200	A.
The period						3,560,000	
1908.							
January	1,330	985	1,150	.513	.59	70,700	B.
February	1,230	940	1,050	.469	.51	60,400	B.
March	6,020	1,030	2,230	.996	1.15	137,000	A.
April	11,000	1,940	6,200	2.77	3.09	369,000	A.
May	9,270	5,510	7,040	3.14	3.62	433,000	A.
June	9,270	5,510	7,560	3.38	3.77	450,000	A.
July	7,880	1,670	4,480	2.00	2.31	275,000	A.
August	1,670	1,280	1,430	.638	.74	87,900	A.
September	1,800	1,130	1,250	.558	.62	74,400	A.
October	3,150	1,080	1,530	.683	.79	94,100	A.
November	1,500	1,330	1,420	.634	.71	84,500	A.
December	1,280	985	1,100	.491	.57	67,600	A.
The year	11,000	940	3,040	1.36	18.47	2,200,000	

MALHEUR RIVER BASIN.

DESCRIPTION.

Malheur River rises in the eastern part of Harney County, flows northward, receiving the Middle Fork near Riverside, the North Fork near Juntura, and Bully Creek at Vale, and discharges into Snake River at Ontario. Its drainage area, which includes the southeastern slope of the Blue Mountains and the eastern border of the divide that marks the boundary of the Great Basin in Oregon, is fan-shaped, the outer border extending 140 miles along the mountain summits. The basin at the mouth of the river measures 4,150 square miles, and at Riverside 1,910 square miles.

Elevations within the basin range from 5,000 feet at the headwaters to 2,000 at the mouth. The country is generally rough and broken and is largely covered with sage brush, and irrigation is restricted to the lower lands immediately adjoining the streams. The headwater areas are lightly forested, but elsewhere the area is timberless and is utilized as range land for cattle and sheep.

The mean annual rainfall ranges from 16 inches on the headwaters to 10 inches at Vale. During the winter months the streams are icebound for part of the time.

This area offers some exceptional advantages for irrigation, for in it are conjoined large storage possibilities, ample stream flow, and enormous areas of desert lands. The United States Reclamation

Service has under consideration a project which contemplates the construction of reservoirs on the headwaters of the Malheur and its principal tributaries.

The following gaging stations have been maintained in this river basin:

Malheur River at Halliday's bridge near Ontario (1904 to 1905).
Malheur River at Vale (1890 to 1896 and 1903 to 1908).
Malheur River at McLaughlin's bridge near Vale (1904 to 1906).
Malheur River near Westfall (1903 to 1905).
Willow Creek at Dell (1904 to 1906).
Willow Creek near Malheur (1904 to 1906).
Bully Creek at Vale (1904 and 1905).
Bully Creek at Warm Springs (1905 to 1907).
Middle Fork of Malheur River at Riverside (1906 and 1908).

During the period covered by these records, the flow of the Malheur appears to have been greatest in 1904 and lowest in 1895. The earlier records are not as dependable as those of later years.

MALHEUR RIVER AT VALE, OREG.

This station was originally established March 20, 1890. Observations were suspended June 30, 1891, resumed January 1, 1895, suspended again September 30, 1896, and again resumed May 20, 1903. Since the latter date they were interrupted only from April 1, 1907, to May 29, 1908. The station at present is located within the city limits of Vale, one-fourth mile below the mouth of Bully Creek, and 2½ miles above the mouth of Willow Creek. The datum of the chain gage has not been changed since May 20, 1903.

The data obtained at this station are very valuable, as the waters of the stream are extensively used for irrigation, the low-water flow being entirely appropriated for this purpose. Unfortunately measurements do not show the natural flow of the stream because of diversions for irrigation above. During 1904 and 1905, while the Malheur project was under investigation by the United States Reclamation Service, measurements were made during the irrigating season of the more important ditches. The following table gives the principal canals, the location of the head-gate, and the maximum amount diverted, as shown by measurements taken in 1904 and 1905:

Canals in Malheur River drainage, Oregon.

Name of ditch.	Location of head-gate.	Maximum diversion.
		Sec.-ft.
Vines ditch	14 miles above Vale	3.7
Malheur Farmers canal	13 miles above Vale	84
McLaughlin's ditch	12 miles above Vale	19
J. H. ditch	11½ miles above Vale	11.1
Linebarger ditch	10 miles above Vale	2.7
Gellerman & Froman ditch	8 miles above Vale	71
Sand Hollow ditch	6 miles above Vale	12.6
Hope Mill ditch	2 miles above Vale	12.3
Nevada ditch	1 mile below Vale	107
Brosman ditch	11 miles below Vale	4

Any future development must involve the construction of reservoirs on the headwaters of the stream.

During the winter months the records of flow are rendered somewhat inaccurate by ice conditions. As the bed of the stream is composed of shifting sand, a permanent rating curve can not be obtained. Unless a number of measurements are made each season it is impossible to prepare reliable estimates of flow.

Discharge measurements of Malheur River at Vale, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 26	I. E. Oakes	125	600	6.75	1,790
1908. May 29	H. D. McGlashan	108	221	4.05	150

Daily gage height, in feet, of Malheur River at Vale, Oreg., for 1907 and 1908.

[Z. G. Wilson, observer.]

Day.	1907.[a]			1908.[b]							
	Jan.	Feb.	Mar.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.28	7.06	5.92	.....	4.08	4.00	3.35	3.46	3.70	3.96	3.65
2	4.24	6.70	5.82	.....	4.10	3.92	3.32	3.45	3.78	3.95	4.15
3	4.26	5.67	5.75	.....	4.15	3.90	3.30	3.43	3.62	3.95	3.85
4	4.28	9.18	5.61	.....	4.18	3.88	3.28	3.45	3.65	3.98	4.01
5	4.43	13.02	5.56	.....	4.18	3.85	3.30	3.45	3.65	3.90	4.03
6	4.40	11.20	5.48	.....	4.19	3.92	3.28	3.45	3.65	3.95	4.03
7	4.42	9.40	5.56	.....	4.15	3.80	3.25	3.47	3.62	3.95	4.05
8	4.44	7.70	5.82	.....	4.14	3.74	3.25	3.48	3.64	3.90	4.05
9	4.45	6.92	5.74	.....	4.14	3.75	3.24	3.45	3.63	3.88	4.07
10	4.49	6.49	5.70	.....	4.10	3.70	3.22	3.45	3.64	3.86	4.13
11	4.46	6.37	5.68	.....	4.20	3.55	3.20	3.46	3.64	3.85	4.12
12	4.39	6.26	5.69	.....	4.22	3.52	3.22	3.46	3.64	3.84	4.10
13	4.32	6.04	5.62	.....	4.22	3.55	3.22	3.45	3.65	3.92	4.08
14	4.32	5.92	5.52	.....	4.20	3.50	3.25	3.43	3.68	3.93	4.02
15	4.32	5.88	5.44	.....	4.18	3.95	3.30	3.45	3.70	3.92	3.85
16	4.30	5.87	5.40	.....	4.20	3.65	3.28	3.46	3.82	3.93	3.69
17	4.27	5.85	7.20	.....	4.18	3.48	3.25	3.46	3.90	3.96	3.65
18	4.25	5.87	8.05	.....	4.15	3.50	3.25	3.48	3.95	3.95	3.68
19	4.24	5.80	9.52	.....	4.10	3.45	3.28	3.60	3.96	3.96	3.70
20	4.21	5.70	10.41	.....	4.12	3.42	3.28	3.62	3.95	3.97	3.70
21	4.24	5.72	9.30	.....	4.20	3.40	3.25	3.60	3.95	3.98	3.70
22	4.26	5.81	8.54	.....	4.25	3.40	3.23	3.65	3.94	4.01	3.68
23	4.28	5.82	8.14	.....	4.25	3.34	3.35	3.67	3.92	4.04	3.72
24	4.28	5.98	7.74	.....	4.30	3.40	3.35	3.65	3.88	4.06	3.72
25	4.27	5.92	7.32	.....	4.28	3.35	3.38	3.65	3.85	4.08	3.74
26	4.28	6.15	7.12	.....	4.25	3.40	3.38	3.54	3.85	4.03	3.80
27	4.27	6.56	6.90	.....	4.14	3.40	3.38	3.55	3.88	4.00	3.84
28	4.28	6.16	6.67	.....	4.02	3.42	3.38	3.56	3.88	3.88	3.84
29	4.42	.....	6.45	4.08	4.08	3.45	3.38	3.55	3.87	3.86	3.87
30	6.67	.....	6.25	4.06	4.02	3.40	3.38	3.56	3.95	3.80	3.87
31	7.02	.....	6.22	4.08	.....	3.30	3.39	.....	3.96	.....	3.91

[a] River never more than two-thirds frozen over at gage. Maximum thickness of ice January 20, 10 inches. The ice went out February 5.

[b] River entirely frozen over December 18 to 31; ice 5 to 7 inches thick.

Rating tables for Malheur River at Vale, Oreg.

1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	130	5.70	955	7.20	2,370	9.40	5,150
4.30	160	5.80	1,030	7.30	2,480	9.60	5,430
4.40	195	5.90	1,110	7.40	2,595	9.80	5,710
4.50	235	6.00	1,190	7.50	2,710	10.00	6,000
4.60	280	6.10	1,275	7.60	2,825	10.20	6,290
4.70	325	6.20	1,360	7.70	2,940	10.40	6,580
4.80	375	6.30	1,450	7.80	3,060	10.60	6,870
4.90	430	6.40	1,545	7.90	3,180	10.80	7,170
5.00	490	6.50	1,640	8.00	3,300	11.00	7,470
5.10	550	6.60	1,740	8.20	3,550	12.00	8,970
5.20	610	6.70	1,840	8.40	3,810	13.00	10,570
5.30	675	6.80	1,940	8.60	4,070	14.00	12,220
5.40	740	6.90	2,045	8.80	4,330		
5.50	810	7.00	2,150	9.00	4,600		
5.60	880	7.10	2,260	9.20	4,870		

1908.[b]

3.20	40	3.50	63	3.80	99	4.10	160
3.30	47	3.60	72	3.90	117	4.20	185
3.40	55	3.70	84	4.00	138	4.30	213

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 13 discharge measurements made during 1906–7 and is well defined between gage heights 4.4 feet and 11.0 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908 and form of previous curve, and is fairly well defined.

Monthly discharge of Malheur River at Vale, Oreg., for 1907 and 1908.

[Drainage area, 4,860 square miles.]

Month.	Discharge in second-feet.				Run-off.		
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	Accuracy.
1907.							
January	2,170	133	287	0.059	0.07	17,600	B.
February	10,600	932	2,190	.451	.47	122,000	A.
March	6,590	740	1,960	.403	.46	121,000	A.
1908.							
June	213	142	177	.036	.04	10,500	B.
July	138	47	77.0	.016	.02	4,730	B.
August	54	40	47.0	.010	.01	2,890	C.
September	80	57	64.7	.013	.01	3,850	C.
October	130	74	99.8	.021	.02	6,140	B.
November	156	99	126	.026	.03	7,500	B.
December 1–17	168	78	135	.028	.02	4,550	B.
The period						40,200	

MIDDLE FORK OF MALHEUR RIVER AT RIVERSIDE, OREG.

This station, which was established January 3, 1906, was abandoned March 7, 1907, because of its inaccessibility and the impossibility of getting a sufficient number of measurements except at an excessive cost. It was, however, reestablished on December 15, 1908, and is being maintained at the present time. It is located one-half mile above Riverside post-office, which is reached by stage 125 miles from

Vale. It is 200 feet above the mouth of the Malheur River. A gage was also installed on the Middle Fork of the Malheur about one-half mile below the mouth of the South Fork, where measurements are made in conjunction with those at the regular stations above.

The data obtained here will be chiefly of value in determining the storage possibilities on this river for irrigation.

The conditions at the station are not favorable for good results. The bed of the stream is composed of sand and gravel and changes at every freshet. During the winter months the river freezes and ice gorges frequently form, which back water above the gage.

Daily gage height, in feet, of Middle Fork of Malheur River at Riverside, Oreg., for 1907 and 1908.

[J. C. Blaylock, observer.]

Day.	1907.[a]			1908.	Day.	1907.[a]			1908.
	Jan.	Feb.	Mar.	Dec.[b]		Jan.	Feb.	Mar.	Dec.[b]
1	1.3	3.05	2.4	.....	16	1.8	2.2	2.9	1.4
2	1.3	2.1	2.3	.....	17	1.8	2.2	3.1	1.4
3	1.3	3.5	2.1	.....	18	1.8	2.2	3.65	1.4
4	1.3	7.2	2.1	.....	19	1.7	2.1	5.6	1.4
5	1.3	7.7	2.0	.....	20	1.6	2.1	4.7	1.3
6	1.3	5.7	2.0	.....	21	1.6	2.2	3.8	1.3
7	1.5	3.8	2.3	.....	22	1.6	2.2	3.45	1.3
8	1.4	2.95	2.2	.....	23	1.5	2.2	3.25	1.25
9	1.4	2.5	2.2	.....	24	1.5	2.2	2.95	1.2
10	1.4	2.6	2.1	.....	25	1.7	2.2	2.6	1.2
11	1.3	2.5	2.0	.....	26	1.6	2.95	2.8	1.4
12	1.3	2.5	2.0	.....	27	1.6	2.5	2.5	1.6
13	1.6	2.3	2.0	.....	28	2.4	2.5	2.3	1.7
14	1.6	2.3	1.95	.....	29	1.7	.....	2.4	1.7
15	1.8	2.2	2.8	.....	30	2.65	.....	2.3	1.6
					31	2.55	.....	2.4	1.6

[a] The river was frozen about 8 inches thick at the gage during the first part of January. The ice went out about February 7.
[b] River frozen over December 20 to 31.

BULLY CREEK NEAR VALE, OREG.

This station, which was first established August 10, 1903, was destroyed by flood and discontinued March 11, 1904, in favor of a station at the mouth of the creek. It was again established January 29, 1905, and maintained until March 31, 1907, when it was discontinued for lack of funds. It was located 13 miles above the mouth of the creek and 2 miles below the mouth of Cottonwood Creek.

The data obtained have considerable value, for the creek affords storage facilities important to the development of irrigation in the Malheur basin.

The conditions at the station have never been favorable for good results, and dependable estimates of discharge can be made only when it is possible to secure a large number of measurements throughout each season.

Daily gage height, in feet, of Bully Creek near Vale, Oreg., for 1907.

[F. O'Neil, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	1.52	3.00	2.34	16	1.64	2.40	2.30
2	1.54	3.00	2.30	17	1.66	2.40	2.50
3	1.54	3.60	2.28	18	1.66	2.38	5.50
4	1.56	3.40	2.28	19	1.68	2.36	4.20
5	1.56	4.50	2.28	20	1.68	2.34	3.90
6	1.58	4.00	2.28	21	1.68	2.30	3.60
7	1.58	3.50	2.28	22	1.68	2.30	3.54
8	1.60	3.00	2.30	23	1.66	2.30	3.30
9	1.60	2.68	2.30	24	1.66	2.30	3.30
10	1.60	2.60	2.30	25	1.66	2.50	3.40
11	1.60	2.56	2.30	26	1.66	2.48	3.50
12	1.60	2.50	2.30	27	1.66	2.44	3.30
13	1.60	2.46	2.30	28	1.66	2.40	3.20
14	1.60	2.44	2.30	29	3.35	.....	3.10
15	1.64	2.40	2.30	30	2.60	.....	3.00
				31	4.30	.....	3.06

NOTE.—The river was frozen at the gage about 8 inches beginning December 12, 1906. The ice from this freeze went out January 29.

Rating table for Bully Creek near Vale, Oreg., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	7	2.50	140	3.50	470	4.50	1,040
1.60	12	2.60	165	3.60	515	4.60	1,110
1.70	19	2.70	190	3.70	565	4.70	1,180
1.80	28	2.80	215	3.80	615	4.80	1,250
1.90	38	2.90	245	3.90	670	4.90	1,325
2.00	50	3.00	275	4.00	725	5.00	1,400
2.10	65	3.10	310	4.10	785	5.20	1,570
2.20	80	3.20	345	4.20	845	5.40	1,760
2.30	100	3.30	385	4.30	910	5.60	1,960
2.40	120	3.40	425	4.40	975		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based upon 4 discharge measurements made during 1906, and is fairly well defined.

Monthly discharge of Bully Creek near Vale, Oreg., for 1907.

[Drainage area, 650 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	910	8	60.1	0.092	0.11	3,700	C.
February	1,040	100	233	.358	.37	12,900	B.
March	1,860	96	303	.466	.54	18,600	B.

POWDER RIVER BASIN.

DESCRIPTION.

Powder River, which drains the eastern slope of the Blue Mountains, rises in the extreme western portion of Baker County, flows west, then north through Baker City to the town of North Powder,

where it turns abruptly to the southeast and empties into the Snake River in the east central part of Baker County.

The general elevation of the headwaters is 6,000 feet above sea level, while that of the valley is 3,300 feet. Sumpter is 4,415 feet above sea level, and Baker City, 3,586 feet. The only important tributary stream is Eagle Creek, which drains the southern part of the Powder River Mountains and empties into the Powder near its mouth. The total drainage area of Powder River at the mouth is 1,660 square miles; at Baker City it is 341 square miles.

At the headwaters the country is mountainous and heavily forested and the principal industry is mining and lumbering. The valley of the Powder has not been greatly developed, although a number of irrigation ditches are in operation. Any extensive development will involve the construction of storage reservoirs, for which facilities are not lacking.

The mean annual rainfall at Baker City is 15 inches; in the headwater region it is probably twice that amount, the greater part falling during the winter in the form of snow. The determination of stream flow in this area is rendered somewhat difficult during the winter as the streams are icebound for weeks at a time.

The lowest run-off from this basin since records have been kept occurred in 1905; the highest occurred in 1904, but 1907 was a close second.

Only one gaging station has been maintained in this basin—that at Salisbury.

POWDER RIVER AT SALISBURY, OREG.

This station, which was established December 20, 1903, is located 10 miles above Baker City and one-fourth mile below Salisbury, a station on the Sumpter Valley Railroad. It is above all important diversions for the Powder River valley.

The data are of considerable practical value, as the waters are used for mining above the station and for irrigation below. They are also of scientific interest because this drainage area was once quite heavily forested, but has of recent years been logged off.

During the winter months the stream frequently remains frozen for long periods, and although an attempt has been made to develop rating curves for ice conditions, the results have not been very satisfactory.

Discharge measurements of Powder River at Salisbury, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	I. E. Oakes	43	86	3.71	326
1908.					
May 30	H. D. McGlashan	41	56	3.00	187

Daily gage height, in feet, of Powder River at Salisbury, Oreg., for 1907 and 1908.

[R. M. Garrett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	2.45	2.7	3.15	3.45	4.25	4.2	3.05	2.35	1.95	1.9	1.95	2.25
2	2.4	2.75	3.1	3.35	4.15	4.05	2.95	2.3	1.9	1.85	1.95	2.25
3	2.35	2.75	3.15	3.55	4.1	3.95	2.95	2.25	1.85	2.0	2.0	2.25
4	2.3	2.65	3.05	3.55	3.95	3.85	3.0	2.2	1.85	2.05	2.0	2.2
5	2.4	3.35	2.9	3.45	4.0	3.7	3.0	2.2	1.8	2.05	1.9	2.15
6	2.4	3.65	3.1	3.6	4.05	3.65	3.05	2.15	1.8	2.0	1.9	2.1
7	2.35	3.45	3.1	4.0	4.05	3.45	2.85	2.1	1.95	1.95	1.85	2.15
8	2.35	3.15	3.1	4.45	4.15	3.15	2.85	2.15	1.95	1.95	1.85	2.15
9	2.4	3.15	3.2	4.3	4.25	3.05	2.85	2.15	1.95	1.95	1.85	2.25
10	2.4	3.15	3.2	4.4	4.35	3.25	2.75	2.15	2.0	1.95	1.85	2.25
11	2.4	3.1	3.15	4.55	4.15	3.5	2.65	2.1	2.0	1.9	1.95	2.25
12	2.3	3.25	3.05	4.85	4.05	3.75	2.75	2.05	1.85	1.9	1.95	2.35
13	2.3	3.15	3.15	5.05	4.2	3.4	2.85	2.05	1.85	1.85	1.95	2.35
14	2.35	3.05	3.05	5.05	4.3	3.05	2.75	2.0	1.9	1.85	2.05	2.25
15	2.35	3.05	3.15	4.95	4.55	3.05	2.7	2.1	1.85	1.8	2.05	2.25
16	2.35	3.15	3.15	4.75	4.45	3.05	2.6	2.05	1.9	1.85	2.05	2.2
17	2.35	3.15	3.1	4.45	4.55	2.95	2.65	2.05	1.85	1.9	2.05	2.15
18	2.45	3.25	3.6	4.25	4.8	2.85	2.75	2.0	1.9	1.85	2.05	2.2
19	2.45	3.5	4.15	4.05	4.75	2.75	2.65	1.95	1.9	1.85	2.05	2.2
20	2.4	3.75	4.25	4.0	4.65	2.7	2.55	1.95	1.9	1.85	2.15	2.2
21	2.35	3.65	4.1	4.05	4.4	2.9	2.55	1.95	1.85	1.9	2.15	2.15
22	2.3	3.55	3.85	4.15	4.05	2.95	2.45	1.9	1.85	1.95	2.15	2.25
23	2.4	3.65	3.8	4.25	3.85	3.05	2.5	1.95	1.9	1.95	2.15	2.35
24	2.4	3.7	3.6	4.35	3.8	2.95	2.45	1.95	1.85	2.0	2.05	2.35
25	2.3	4.1	3.65	4.2	4.05	2.95	2.45	1.95	1.8	1.95	2.05	2.4
26	2.45	3.95	3.55	4.1	4.1	2.95	2.35	1.95	1.8	2.0	2.05	2.4
27	2.55	3.55	3.45	3.95	4.15	2.95	2.3	1.9	1.9	2.0	2.1	2.3
28	2.55	3.25	3.15	3.85	4.25	2.95	2.25	1.85	1.9	2.0	2.2	2.25
29	2.6	.....	3.1	3.95	4.2	2.9	2.2	1.8	1.8	1.95	2.2	2.25
30	2.65	.....	3.1	4.15	4.15	.....	2.2	1.85	1.9	2.0	2.25	2.35
31	2.7	.....	3.25	.....	4.25	.....	2.15	1.85	.....	2.0	.....	2.35
1908.[b]												
1	.....	2.15	2.45	3.05	4.15	3.15	2.75	2.1	1.1	1.9	2.3	2.05
2	.....	2.15	2.5	3.1	4.05	3.2	2.65	2.15	1.2	1.8	2.25	2.1
3	.....	2.25	2.5	3.2	4.0	3.25	2.65	2.1	1.15	1.8	2.25	2.0
4	.....	2.25	2.5	3.25	3.95	3.5	2.55	2.05	1.15	1.9	2.25	2.1
5	2.05	2.3	2.4	3.35	3.85	3.3	2.55	2.0	1.1	2.0	2.35	2.15
6	2.05	2.25	2.35	3.35	3.85	3.15	2.65	2.1	1.15	2.0	2.35	2.15
7	2.05	2.25	4.45	3.4	4.05	3.15	2.65	2.05	1.15	1.9	2.3	2.1
8	2.05	2.3	2.5	3.5	4.15	3.15	2.7	2.0	1.15	1.9	2.15	2.1
9	2.1	2.15	2.4	3.65	3.45	3.15	2.75	1.9	1.2	1.8	2.0	2.15
10	2.05	2.15	2.45	3.7	3.15	3.15	2.85	1.8	1.15	1.9	1.9	2.1
11	2.05	2.2	2.55	3.75	3.15	3.35	2.85	1.75	1.1	2.05	1.85	2.05
12	2.1	2.2	2.5	3.85	3.1	3.25	2.95	1.7	1.0	2.1	1.75	2.1
13	2.1	2.25	2.6	3.9	3.15	3.35	2.95	1.65	1.1	2.15	1.75	2.05
14	2.05	2.25	2.65	4.05	3.15	3.45	2.85	1.6	1.25	2.2	1.75	2.0
15	2.05	2.3	3.2	4.15	3.05	3.4	2.75	1.55	1.35	2.25	1.85	1.95
16	2.15	2.3	4.3	4.25	3.05	3.25	2.65	1.45	1.35	2.15	1.95	1.9
17	2.15	2.35	3.85	4.05	3.05	3.25	2.65	1.45	1.4	2.15	2.05	1.8
18	2.2	2.35	3.8	3.8	3.15	3.4	2.55	1.45	1.55	2.15	2.1	1.8
19	2.25	2.35	3.7	3.95	3.25	3.35	2.45	1.45	1.85	2.25	2.15	1.85
20	2.25	2.4	3.7	4.05	3.15	3.25	2.35	1.35	1.85	2.15	2.15	1.9
21	2.25	2.4	3.7	4.35	3.15	3.3	2.35	1.35	1.85	2.1	2.05	1.9
22	2.15	2.4	3.55	4.25	3.1	3.35	2.35	1.35	1.8	2.1	2.05	1.85
23	2.15	2.4	3.45	4.15	3.05	3.4	2.35	1.3	1.75	2.15	2.1	1.85
24	2.15	2.45	3.5	4.05	3.05	3.3	2.45	1.25	1.7	2.2	2.1	1.95
25	2.2	2.5	3.3	3.85	3.15	3.25	2.45	1.2	1.7	2.15	2.05	1.95
26	2.25	2.5	3.15	3.75	3.15	3.2	2.35	1.2	1.65	2.1	2.05	1.95
27	2.25	2.45	3.1	3.85	3.05	3.15	2.3	1.15	1.65	2.05	2.05	1.95
28	2.25	2.45	3.0	3.9	3.05	3.1	2.2	1.1	1.65	2.15	2.1	2.0
29	2.25	2.35	3.0	4.05	2.95	3.1	2.15	1.1	1.65	2.25	2.1	2.1
30	2.25	.....	2.85	4.15	3.0	2.95	2.1	1.05	1.65	2.35	2.05	2.05
31	2.1	.....	2.9	.....	3.15	.....	2.0	1.0	.....	2.35	.....	2.1

[a] River frozen November 20, 1906, to February 10, 1907, although center of channel was open after January 15. Frozen entirely over on December 25, 1906, to a depth of 4 to 5 inches.

[b] The river was frozen January 5 to 11 and December 13 to 19.

NOTE.—The discharge of the river fluctuates somewhat on account of placer mining upstream.

Rating tables for Powder River at Salisbury, Oreg., for 1907 and 1908.

OPEN CHANNEL CONDITIONS, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	11	2.70	102	3.60	305	4.50	639
1.90	16	2.80	119	3.70	336	4.60	682
2.00	22	2.90	137	3.80	369	4.70	725
2.10	30	3.00	155	3.90	403	4.80	768
2.20	38	3.10	176	4.00	440	4.90	812
2.30	48	3.20	198	4.10	478	5.00	856
2.40	60	3.30	223	4.20	516	5.20	944
2.50	72	3.40	250	4.30	554		
2.60	86	3.50	277	4.40	596		

OPEN CHANNEL CONDITIONS, 1908.[b]

1.00	0.1	1.90	20	2.80	144	3.70	370
1.10	0.4	2.00	27	2.90	165	3.80	400
1.20	0.8	2.10	36	3.00	187	3.90	430
1.30	1.6	2.20	47	3.10	209	4.00	465
1.40	2.6	2.30	59	3.20	232	4.20	535
1.50	4.3	2.40	73	3.30	256	4.40	605
1.60	6.7	2.50	89	3.40	282		
1.70	10	2.60	105	3.50	310		
1.80	14	2.70	124	3.60	340		

ICE CONDITIONS, 1907.[c]

2.30	23	2.70	42	3.10	71	3.50	110
2.40	27	2.80	48	3.20	80	3.60	122
2.50	32	2.90	55	3.30	89	3.70	135
2.60	37	3.00	63	3.40	99		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 15 discharge measurements made during 1904–1907, and is fairly well defined for 1907.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908 and the form of previous curves and is not well defined.

[c] This table is applicable only for ice conditions. It is based on 3 discharge measurements made at times of ice obstruction during 1904–1906, and is not well defined.

Monthly discharge of Powder River at Salisbury, Oreg., for 1907 and 1908.

[Drainage area, 275 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	42	23.0	27.9	0.101	0.12	1,720	C.
February	478	40	185	.673	.70	10,300	C.
March	535	137	243	.884	1.02	14,900	B.
April	878	236	516	1.88	2.10	30,700	B.
May	768	369	529	1.92	2.21	32,500	B.
June	516	102	220	.800	.89	13,100	B.
July	166	34	98.0	.356	.41	6,030	B.
August	54	11	26.2	.095	.11	1,610	B.
September	22	11	15.4	.056	.06	916	B.
October	26	11	18.4	.067	.08	1,130	B.
November	43	14	24.9	.091	.10	1,480	B.
December[a]	54	30	36.8	.134	.15	2,260	C.
The year	878	11	162	.588	7.95	117,000	

[a] Discharge estimated December 22 to 31, 1907, and January 1 to 4, 1908. Discharge applied as for open channel January 5 to 11, and December 13 to 19, 1908.

Monthly discharge of Powder River at Salisbury, Oreg., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January [a]	53	30	40.3	0.147	0.17	2,480	C.
February	89	42	61.8	.225	.24	3,550	C.
March	570	66	202	.735	.85	12,400	B.
April	588	198	404	1.47	1.64	24,000	B.
May	518	176	279	1.01	1.16	17,200	B.
June	310	176	245	.891	.99	14,600	B.
July	176	27	100	.364	.42	6,150	C.
August	42	.1	12.0	.044	.05	738	D.
September	17	.1	5.31	.019	.02	316	D.
October	66	14	36.3	.132	.15	2,230	C.
November	66	12	36.0	.131	.15	2,140	C.
December [a]	42	14	28.5	.104	.12	1,750	C.
The year	588	0.1	121	.440	5.96	87,600	

[a] Discharge estimated December 22 to 31, 1907, and January 1 to 4, 1908. Discharge applied as for open channel January 5 to 11, and December 13 to 19, 1908.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Powder River drainage basin, Oregon, in 1907 and 1908:

Miscellaneous measurements in Powder River Drainage Basin, Oregon, in 1907–8.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
August 19, 1907	Powder River	Snake River	Sumpter	11
August 21, 1907	do	do	Haines	16
July 27, 1907	do	do	Above North Fork near North Powder.	110
September 7, 1908	do	do	Sec. 26, T. 6 S., R. 40 E	[a] 10
August 16, 1907	do	do	Erwin	3.6
July 7, 1907	do	do	Sec. 32, T. 8 S., R. 43 E	295
August 20, 1907	Goodrich Creek	Powder River	Wingville	2.6
Do	Willow Creek	do	Sec. 5, T. 8 S., R. 39 E	3.4
February 11, 1907	Dutch Flat Creek	do	Haines	4.7
August 20, 1907	Rock Creek	do	One-half mile above Rock Creek.	28
Do	Muddy Creek	do	2 miles west of Rock Creek	2
July 27, 1907	North Fork of Powder River.	do	North Powder	25
July 9, 1907	Eagle Creek	do	Newbridge	1,040
Do	Fuller ditch	do	Opposite Newbridge	4.8
Do	Holcomb ditch	do	do	.9
Do	Hostine ditch	do	do	6.7
Do	Moody ditch	do	do	14
Do	Newton Young ditch	do	do	32
Do	Waterbury ditch	do	do	14
August 8, 1907	Basha ditch	do	Miles	26
August 17, 1907	do	do	do	14
August 8, 1907	Lower Powder Ditch and Dam Co.'s ditch.	do	do	7.6
Do	North Side ditch	do	do	9.9

[a] Measurement made at Thief Valley dam site; low water.

GRANDE RONDE RIVER BASIN.

DESCRIPTION.

Grande Ronde River, which drains the eastern slope of the Blue Mountains in Oregon and the northern slopes of the Powder River Mountains (a comparatively high range that runs at right angles to

the Blue Mountain Range), rises on the divide in the extreme southern portion of Union County, flows in a generally northeasterly direction and empties into Snake River at Zindel, Washington, about 12 miles from the point where the Snake crosses the Oregon-Washington line. The principal tributaries of the Grande Ronde are Joseph Creek, which drains the Chesnimnus Forest Reserve, the Wallowa, which rises in the Powder Mountains and drains the Wallowa Forest Reserve, and Catherine Creek, which drains the western portion of the Powder Mountains. The drainage area of Grande Ronde River at its mouth is 3,950 square miles. Above the mouth of the Wallowa the drainage area is 1,590 square miles.

The topography of this basin is generally rough, the area being almost entirely surrounded by mountain ranges which slope gradually to Grande Ronde Valley, a large area of agricultural land approximately 2,700 feet above the sea level. The general elevation of the Powder and Blue mountains from which the river receives its water supply is 8,000 feet.

The drainage area of this river except in the agricultural valleys is almost entirely forested, a large part being included in the national forest reserves. The mean annual rainfall at La Grande is 19 inches, but on the headwaters of the stream it is probably 35 inches. The greater part of this precipitation occurs during the winter months as snow. The river is subject to an annual spring rise due to the melting of snow in the mountains, and damaging floods are frequently caused by the sudden melting of snows by "chinook" winds.

The agricultural activities have in the past been largely confined to the production of wheat, and irrigation has not been practiced to an elaborate extent, although exceptionally good possibilities are afforded. Only the lower valley lands immediately contiguous to the streams have been irrigated, but there are at present under consideration a number of larger projects that involve the construction of reservoirs and the irrigation of large areas by means of long canals. Records of the flow of some of the streams in this basin have been kept since 1904. The year 1905 was a "dry year" and all streams in the basin carried less quantities of water than during other years covered by the records. The year 1907 was a "wet year."

The following gaging stations have been maintained in this drainage basin:

Grande Ronde River at Hilgard, Oreg. (1903 to 1908).
Grande Ronde River at Elgin, Oreg. (1903 to 1908).
Grande Ronde River at Zindel, Wash. (1904 to 1908).
Catherine Creek near Union, Oreg. (1907).
Wallowa River near Joseph, Oreg. (1903 to 1908).
Wallowa River near Wallowa, Oreg. (1903 to 1907).
Wallowa River near Elgin, Oreg. (1903 to 1908).

GRANDE RONDE RIVER AT HILGARD, OREG.

This station, which was established November 6, 1903, is located one-half mile below Hilgard station, on the Oregon Railroad and Navigation line, and just below the mouth of Five Points Creek, which is the most important tributary above the Grande Ronde Valley.

The data obtained here are necessary to determine the quantity of water available for irrigation in Grande Ronde Valley, at the head of which the station is located.

At this point the river is chiefly used for the transportation of logs, and it has been almost impossible to obtain reliable records of flow. There are a number of dams on the stream, behind which water is impounded and then released in order to carry the logs to their destination. Many times logs are grounded on the bars below the station and even in the cross section where measurements are made, producing back-water influence.

Gage heights for 1906 were omitted from Water Supply Paper No. 214 as they were considerably affected by backwater from log jams. It is now believed that this obstruction existed for only a small portion of the year, and as such periods are fairly well covered by discharge measurements and observer's notes, discharges have been recomputed, making proper allowance for backwater.

Discharge measurements of Grande Ronde River at Hilgard, Oreg., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 10	R. S. Hall	108	371	5.18	745
April 3	do	102	378	4.88	1,140
May 16	do	70	370	[a] 6.74	657
June 22	do	70	242	3.74	238
December 4 [b]	Stevens and McGlashan	70	181	3.02	66
1907.					
May 1	I. E. Oakes	94	266	4.37	721
September 13	E. F. Kriegsman	68	173	2.73	33
1908.					
May 31	H. D. McGlashan	70	279	3.85	362
October 21 [c]	L. R. Allen	68	203	3.00	50

[a] Backwater from log jam.
[b] Ice measurement.
[c] Measurement very uncertain; it was made with a meter in poor condition. There were water-soaked logs in measuring section, which had been in all the season.

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1906.

[James Mangers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.[a]												
1	3.2	3.1	3.25	6.0	4.0	5.5	3.1	2.85	2.7	2.7	2.8	3.0
2	3.1	3.1	3.25	5.8	4.0	5.5	3.1	2.85	2.7	2.7	2.8	2.95
3	3.1	3.0	3.35	5.0	3.95	5.5	3.3	2.8	2.7	2.7	2.8	3.0
4	3.15	3.2	3.4	4.9	4.0	5.4	3.3	2.8	2.7	2.8	2.9	3.0
5	3.18	3.25	3.25	4.6	4.1	5.3	3.3	2.8	2.7	2.8	2.9	3.0

[a] River frozen March 19 to 21, November 19 to 22 and 24, December 1 to 8, 14 to 17 and 28 to 31. The ice was probably thin and does not appear to have affected the gage heights materially.

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
6	3.1	3.1	3.25	4.5	4.0	5.3	3.3	2.8	2.7	2.8	2.85	3.0
7	3.15	3.1	4.35	4.9	4.0	5.0	3.2	2.8	2.7	2.8	2.8	3.1
8	3.2	3.1	4.7	4.7	4.0	4.9	4.5	2.8	2.7	2.8	2.85	3.1
9	3.2	3.1	5.0	5.0	4.5	4.95	3.2	2.8	2.7	2.8	2.8	3.1
10	3.2	3.25	5.7	4.5	4.0	4.8	3.05	2.8	2.7	2.8	2.9	3.1
11	3.22	3.25	5.8	5.0	4.0	4.5	3.0	2.8	2.7	2.8	2.95	3.1
12	3.2	3.25	4.5	4.5	4.0	4.6	3.0	2.85	2.75	2.8	3.3	3.1
13	3.2	3.3	4.5	4.6	4.0	4.5	3.0	2.95	2.8	2.7	3.1	3.1
14	3.25	3.3	4.6	5.0	5.6	4.4	3.0	2.95	2.85	2.8	3.2	3.15
15	3.25	3.3	4.65	4.1	4.5	4.3	3.0	2.9	2.9	2.8	3.25	3.1
16	3.2	3.2	3.7	5.0	5.6	4.6	3.0	2.85	2.9	2.85	3.15	3.1
17	3.2	3.3	3.7	4.95	4.5	4.4	3.0	2.85	2.8	2.85	3.1	3.1
18	3.22	3.1	3.8	4.9	4.5	4.3	3.0	2.85	2.85	2.85	3.05	3.1
19	3.25	3.25	3.85	4.9	4.3	4.0	3.0	2.8	2.7	2.85	3.1	3.1
20	3.25	3.3	3.95	4.9	4.0	4.0	3.0	2.8	2.7	2.85	3.1	3.1
21	3.0	3.4	4.0	5.0	4.5	4.0	2.9	2.8	2.7	2.85	3.1	3.1
22	3.05	3.45	3.9	5.0	4.6	3.7	2.9	2.8	2.7	2.80	3.1	3.15
23	3.05	3.45	3.95	5.25	4.5	4.0	2.9	2.85	2.7	2.80	3.1	3.8
24	3.10	3.4	6.7	5.0	4.5	4.0	2.9	2.85	2.7	2.80	3.1	3.8
25	3.1	3.4	5.8	5.5	4.5	4.0	2.85	2.85	2.7	2.80	3.1	4.0
26	3.05	3.45	5.0	5.0	4.0	4.0	2.85	2.8	2.7	2.85	3.1	4.8
27	3.05	3.3	6.3	4.2	4.3	4.0	2.85	2.8	2.7	2.85	2.8	4.5
28	3.05	3.35	5.9	4.0	4.6	3.4	2.85	2.75	2.7	2.80	2.8	4.1
29	3.1	.....	5.6	4.0	7.15	3.65	2.85	2.7	2.7	2.80	2.8	4.0
30	3.1	.....	6.15	4.0	6.75	4.9	2.85	2.7	2.7	2.80	3.0	3.9
31	3.5	.....	6.7	.....	6.0	.....	2.85	2.7	.....	2.80	.....	3.6

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1907 and 1908.

[Owen Scott, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	3.6	4.0	5.3	5.3	4.8	4.3	3.7	2.8	2.8	2.8	2.8	2.8
2	3.5	4.0	5.3	5.3	4.5	4.2	3.7	2.8	2.9	2.8	2.8	2.8
3	3.5	4.0	5.3	5.3	4.4	4.15	3.8	2.8	3.2	2.8	2.8	2.8
4	3.9	4.0	4.2	5.3	4.4	4.0	3.9	2.8	3.1	2.8	2.8	2.8
5	3.6	6.0	4.2	5.3	4.4	3.95	3.0	2.8	3.0	2.75	2.8	2.8
6	3.5	5.5	4.2	5.3	4.4	3.9	3.05	2.8	3.0	2.75	2.8	2.8
7	3.6	4.9	4.2	6.5	4.4	3.85	3.1	2.8	3.0	2.75	2.8	2.8
8	3.8	4.6	4.2	6.8	4.5	3.8	3.1	2.8	3.0	2.75	2.8	2.8
9	3.8	4.5	4.2	6.6	4.5	3.8	3.1	2.8	3.0	2.75	2.8	2.8
10	3.8	4.5	4.2	5.6	4.5	3.7	3.1	2.8	3.0	2.75	2.8	2.9
11	3.8	4.5	4.2	5.4	4.4	3.8	3.1	2.8	3.1	2.8	2.8	2.9
12	4.0	4.5	4.2	5.4	4.5	3.8	3.2	2.8	3.25	2.8	2.8	2.9
13	4.0	4.5	4.2	5.4	4.5	3.7	3.2	2.8	3.25	2.8	2.8	2.9
14	4.0	4.5	4.8	5.3	4.5	3.85	3.0	2.8	3.2	2.8	2.8	2.9
15	4.6	4.5	4.8	5.5	4.4	3.7	3.0	2.8	3.2	2.8	2.8	2.9
16	4.5	4.5	4.8	5.5	4.4	3.7	3.0	2.75	3.2	2.8	2.8	2.9
17	4.5	4.5	5.0	5.1	4.6	3.7	3.0	2.75	3.2	2.8	2.8	2.9
18	4.4	4.5	6.1	5.1	4.7	3.6	3.0	2.75	3.1	2.8	2.8	2.9
19	4.5	5.0	6.5	5.1	4.75	3.6	3.0	2.7	3.0	2.8	2.8	2.9
20	4.5	5.0	6.1	5.0	4.7	3.5	3.0	2.7	2.9	2.8	2.85	2.9
21	4.5	5.0	5.85	5.0	4.7	3.5	3.0	2.6	2.8	2.8	2.85	2.9
22	4.5	5.0	5.3	5.0	4.5	3.5	3.0	2.6	2.8	2.8	2.85	3.1
23	4.5	5.3	5.3	5.0	4.4	3.5	3.0	2.6	2.8	2.8	2.9	3.2
24	4.4	5.3	5.3	4.95	4.3	3.5	3.0	3.2	2.8	2.8	2.95	3.3
25	4.35	5.3	5.3	4.8	4.25	3.6	3.0	2.7	2.8	2.8	2.95	3.4
26	4.0	5.3	5.3	4.8	4.2	3.55	2.9	2.7	2.8	2.8	2.8	3.5
27	4.0	5.3	5.3	4.8	4.2	3.6	2.9	2.6	2.8	2.8	2.8	3.6
28	4.0	5.3	5.3	4.8	4.15	3.6	2.9	2.6	2.8	2.8	2.8	3.6
29	4.0	.....	5.3	5.0	4.2	3.6	2.9	2.6	2.8	2.8	2.8	3.6
30	4.0	.....	5.3	4.8	4.2	3.6	2.9	2.8	2.8	2.8	2.8	3.5
31	4.0	.....	5.3	.....	4.15	.....	2.8	2.8	.....	2.8	.....	3.4

[a] River frozen January 1 to February 15; the ice reached a maximum thickness of about 1.5 feet along the banks, but the center of the channel remained open.

Daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	3.4	3.1	3.4	4.8	5.2	3.8	3.5	3.0	2.8	2.8	3.0	2.7
2	3.4	3.0	3.5	4.6	5.2	3.8	3.4	3.0	2.8	2.9	3.0	2.8
3	3.4	3.0	3.5	5.3	5.0	3.8	3.4	3.0	2.8	2.9	3.0	2.8
4	3.5	3.0	3.5	5.3	4.8	3.8	3.4	3.0	2.8	2.9	3.0	2.9
5	3.5	3.0	3.5	5.3	4.8	3.9	3.4	3.0	2.8	2.8	2.9	2.9
6	3.5	3.0	3.5	5.3	4.8	4.1	3.3	3.0	2.8	2.8	2.9	2.9
7	3.5	3.0	3.5	5.3	4.6	4.1	3.3	2.9	2.8	2.9	2.9	2.9
8	3.4	3.0	3.6	5.6	4.5	4.1	3.3	2.8	2.8	2.9	2.9	2.9
9	3.3	3.0	3.7	5.8	4.4	4.1	3.2	2.8	2.8	2.9	2.9	2.9
10	3.2	3.0	3.8	6.0	4.3	4.1	3.1	2.8	2.8	2.9	2.9	2.9
11	3.2	3.0	3.9	6.4	4.3	4.1	3.0	2.8	2.8	2.9	2.9	2.9
12	3.3	3.0	4.0	6.1	4.3	4.1	3.0	2.8	2.8	2.9	2.9	2.9
13	3.3	3.0	4.9	5.8	4.4	4.1	3.1	2.8	2.8	2.9	2.9	3.0
14	3.3	3.0	5.0	5.6	4.5	4.1	3.1	2.8	2.9	2.9	2.9	3.0
15	3.3	3.0	5.6	5.4	4.5	4.0	3.1	2.8	2.9	3.0	3.1	2.9
16	3.3	3.1	7.8	5.4	4.5	4.1	3.2	2.8	2.9	3.0	3.2	2.8
17	3.3	3.1	8.0	5.4	4.4	4.1	3.4	2.8	2.9	2.9	3.3	2.8
18	3.3	3.1	7.6	5.4	4.4	4.1	3.6	2.8	2.9	2.9	3.3	2.8
19	3.3	3.1	6.5	5.6	4.4	4.0	3.4	2.8	2.9	2.9	3.3	2.8
20	3.3	3.0	5.8	5.8	4.4	4.0	3.2	2.8	2.8	2.9	3.3	2.8
21	3.2	3.0	5.5	6.0	4.4	3.9	3.0	2.8	2.8	2.9	3.3	2.8
22	3.2	3.0	5.2	5.8	4.4	3.9	3.0	2.8	2.8	2.9	3.3	2.8
23	3.2	3.0	4.8	5.6	4.4	3.8	3.0	2.8	2.8	2.9	3.3	2.8
24	3.2	3.0	4.8	5.4	4.2	3.8	3.0	2.7	2.8	2.9	3.3	2.9
25	3.2	3.0	4.8	5.4	4.0	3.7	3.0	2.7	2.8	2.9	3.3	2.9
26	3.1	3.1	4.8	5.3	4.0	3.6	3.0	2.7	2.8	2.9	3.3	2.9
27	3.1	3.2	4.8	5.3	3.8	3.6	3.0	2.7	2.8	2.9	3.2	2.9
28	3.1	3.3	4.8	5.3	3.8	3.6	2.9	2.7	2.8	2.9	3.2	2.9
29	3.1	3.3	4.8	5.2	3.8	3.6	3.0	2.8	2.8	3.0	3.0	2.9
30	3.1	.....	4.8	5.2	3.8	3.6	3.0	2.8	2.8	3.0	2.8	2.9
31	3.1	.....	4.8	.....	3.7	.....	3.0	2.8	.....	3.0	.....	2.9

[a] River completely frozen over January 21 to February 6. Ice 2 to 8 inches thick. Also December 15 to 31. Ice 3 to 7 inches thick.

NOTE.—These gage heights were considerably affected at times by backwater from log jams. For the probable extent of these obstructions and corrections made in computing discharge, see footnotes to the table of monthly discharge.

Rating tables for Grande Ronde River at Hilgard, Oreg.

1906 and 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	18	3.80	400	4.90	1,160	6.00	2,140
2.70	28	3.90	455	5.00	1,240	6.20	2,320
2.80	40	4.00	510	5.10	1,330	6.40	2,520
2.90	58	4.10	570	5.20	1,420	6.60	2,720
3.00	82	4.20	630	5.30	1,510	6.80	2,920
3.10	108	4.30	695	5.40	1,600	7.00	3,120
3.20	140	4.40	765	5.50	1,690	7.20	3,340
3.30	174	4.50	840	5.60	1,780	7.40	3,560
3.40	210	4.60	920	5.70	1,870	7.60	3,780
3.50	250	4.70	1,000	5.80	1,960	7.80	4,000
3.60	295	4.80	1,080	5.90	2,050	8.00	4,240
3.70	345						

1908.[b]

2.70	12	3.30	130	3.90	390	4.40	750
2.80	20	3.40	165	4.00	450	4.50	830
2.90	33	3.50	205	4.10	520	4.60	910
3.00	50	3.60	245	4.20	590	4.70	995
3.10	73	3.70	290	4.30	670	4.80	1,080
3.20	100	3.80	338				

[a] This table is based on 10 discharge measurements made during 1904–1907, and is fairly well defined between gage heights 2.7 feet and 5.0 feet. Below gage height 3.5 feet it is not applicable for ice or obstructed-channel conditions; above this it is somewhat smaller than the open-water table to allow for the obstructed conditions generally existing during high-water periods.

[b] This table is based on 4 discharge measurements made during 1906–1908, all of which are believed to have been made under partially obstructed-channel conditions similar to those that existed during 1908. It is fairly well defined between gage heights 3.0 feet and 4.9 feet, but is very uncertain below that. Above gage height 4.8 it is the same as the 1906 and 1907 table.

Monthly discharge of Grande Ronde River at Hilgard, Oreg., for 1906 to 1908.

[Drainage area, 660 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	250	82	129	0.195	0.22	7,930	C.
February	230	82	159	.241	.25	8,830	C.
March	2,820	157	936	1.42	1.64	57,600	D.
April	2,180	510	1,120	1.67	1.86	66,600	C.
May	2,950	350	728	1.10	1.27	44,800	C.
June	1,130	140	599	.908	1.01	35,600	D.
July	840	49	114	.173	.20	7,010	B.
August	70	28	43.8	.066	.08	2,690	B.
September	58	28	32.4	.049	.05	1,930	B.
October	49	28	40.8	.062	.07	2,510	B.
November	174	40	83.8	.127	.14	4,990	B.
December	1,080	66	233	.353	.41	14,300	C.
The year	2,950	28	352	.530	7.20	255,000	
1907.							
January	455	250	260	.394	.45	16,000	D.
February	1,510	250	956	1.45	1.51	53,100	C.
March	2,050	630	1,160	1.76	2.03	71,300	C.
April	2,920	1,080	1,520	2.30	2.57	90,400	C.
May	1,080	600	797	1.21	1.40	49,000	C.
June	695	250	371	.562	.63	22,100	C.
July	455	40	124	.188	.22	7,620	B.
August	140	18	36.8	.056	.06	2,260	B.
September	157	40	82.3	.125	.14	4,900	B.
October	40	34	38.8	.059	.07	2,390	B.
November	70	40	43.5	.066	.07	2,590	B.
December	295	40	106	.161	.19	6,520	C.
The year	2,980	18	458	.694	9.34	328,000	
1908.							
January	205	73	126	.191	.22	7,750	C.
February	130	50	62	.094	.10	3,570	C.
March	4,240	165	1,180	1.79	2.06	72,600	D.
April	2,520	910	1,680	2.55	2.84	100,000	D.
May	1,420	290	757	1.15	1.33	46,500	C.
June	520	245	410	.621	.69	24,400	C.
July	245	33	98.5	.149	.17	6,060	C.
August	50	12	24.9	.038	.04	1,530	D.
September	33	20	22.6	.034	.04	1,340	D.
October	50	20	34.5	.052	.06	2,120	D.
November	130	20	75.8	.115	.13	4,510	D.
December	50	12	29.2	.044	.05	1,800	D.
The year	4,240	12	375	.569	7.73	272,000	

NOTE. The following correction has been made to discharges to allow for obstructed channel conditions:

1906: March 8 to 11, based on measurement of March 10; March 19 to 21, interpolated on account of ice; May 14 to 31, based on a rating curve through measurement of May 16; June, taken as two-thirds the open-channel discharge as indicated by measurement of June 22; December 1 to 6, based on measurement of December 4, on account of ice.

1907: January 7 to February 4, estimated 250 second-feet; February 5 to 8, 840 second-feet, on account of ice; March 14 to 20, 0.6 foot subtracted from gage height before applying table; March 21, based on gage height of 5.6 feet, taken after the logs went out.

The observer makes no note of logs after May 1, 1907, so that no corrections can be made after that date, and the records are more liable to error than before that date. The discharge at this station has been compared with that at Elgin below, and the ratios obtained indicate that the results are fairly reliable as a whole, but that those for the early part of 1908 are probably somewhat too large.

GRANDE RONDE RIVER AT ELGIN, OREG.

This station, which was established November 20, 1903, is located at the lower end of Grande Ronde Valley, within the city limits of Elgin, above the mouth of Clarks Creek and below the mouth of Indian Creek. The datum of the chain gage has not been changed since its installation.

The data collected here have general interest in connection with the study of the run-off of this basin and because of the use of the waters of the stream and tributaries for irrigation in the Grande Ronde Valley.

The conditions at the station are not at all favorable for good results. The bed is exceedingly rough, and at high water the current flows at a decided angle to the bridge from which gagings are made. The estimates published herewith are only fairly accurate.

Discharge measurements of Grande Ronde River at Elgin, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	I. E. Oakes	130	545	4.54	2,730
September 14	E. F. Kriegsman	78	[a] 224	1.77	76
1908.					
June 4	H. D. McGlashan	94	357	3.01	730
October 17	L. R. Allen	88	247	2.01	156

[a] Area doubtful.

Daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1907.

[John Graham, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[a]
1907.												
1	3.5	3.55	4.65	4.0	4.5	4.1	2.95	1.9	1.7	1.9	2.0	2.0
2	3.3	3.7	4.5	4.0	4.45	4.15	2.9	1.85	1.8	1.9	2.0	2.0
3	3.2	3.4	4.25	4.3	4.45	4.15	2.8	1.8	1.8	.....	2.0	2.0
4	3.6	3.4	4.1	4.4	4.45	4.0	2.8	1.8	1.8	1.95	2.0	1.95
5	3.4	5.5	3.9	4.4	4.45	4.0	2.8	1.7	1.85	1.95	2.0	1.95
6	3.75	5.1	3.9	4.5	4.55	4.0	2.7	1.7	1.85	1.95	2.0	1.95
7	2.8	5.4	3.9	4.75	4.55	3.9	2.65	1.65	1.85	1.95	2.0	2.0
8	2.65	5.75	3.85	5.1	4.6	3.8	2.6	1.65	1.85	1.95	2.0	2.0
9	2.9	5.7	3.8	5.35	4.65	.....	2.5	1.65	1.85	1.9	2.0	2.0
10	2.8	5.4	3.9	5.6	4.7	3.6	2.55	1.65	1.85	1.9	2.0	2.0
11	2.8	5.25	3.95	5.8	4.8	3.6	2.45	1.7	1.8	1.9	2.0	2.0
12	2.65	5.1	.....	5.95	4.85	3.65	2.4	1.75	1.8	1.9	1.95	2.1
13	2.7	4.9	3.85	6.1	4.75	3.65	2.4	1.75	.....	1.9	2.0	2.05
14	.....	4.7	3.8	6.15	4.7	3.6	2.4	1.7	1.85	1.9	2.0	2.0
15	2.5	4.6	3.65	6.2	4.6	3.55	2.35	1.65	1.85	1.9	2.0	2.0
16	2.5	4.55	3.6	6.2	4.65	3.45	2.25	1.65	1.9	1.9	2.0	2.3
17	2.45	4.5	3.5	6.05	4.65	3.4	2.2	1.6	1.9	1.9	2.0	2.2
18	2.5	4.45	3.6	6.0	4.7	3.3	2.15	1.65	1.9	1.9	2.05	2.4
19	2.5	4.4	3.6	5.85	4.85	3.3	2.1	1.65	1.9	1.9	2.05	3.0
20	2.5	4.55	4.1	5.6	4.8	3.25	2.1	1.65	1.9	1.9	2.05	2.7
21	2.4	4.85	4.85	5.5	4.85	3.25	2.1	1.65	1.9	1.9	2.05	2.7
22	2.5	4.9	5.0	.....	4.8	3.2	2.0	1.65	1.9	1.9	2.05	2.7
23	2.45	5.0	5.2	5.5	.....	3.15	2.0	1.65	1.9	1.9	2.05	2.95
24	2.45	5.0	5.3	5.45	4.5	3.15	2.0	1.65	1.9	1.9	2.10	2.6
25	2.45	5.1	5.1	5.3	4.4	3.05	2.0	1.65	1.9	1.9	2.15	2.65
26	2.4	5.1	4.65	5.2	4.35	2.9	1.95	1.65	1.9	1.9	2.15	3.1
27	2.3	5.0	4.65	5.1	4.25	2.95	1.95	1.65	1.9	1.9	2.15	2.95
28	2.35	4.8	4.35	4.9	.....	2.95	1.9	1.65	1.9	1.9	2.1	2.5
29	2.7	.....	4.2	4.85	4.15	2.95	1.9	1.7	1.9	1.9	2.1	2.4
30	3.0	.....	4.05	4.65	4.1	2.95	1.9	1.7	1.9	1.95	2.05	2.3
31	3.6	.....	4.0	.....	4.1	.....	1.9	1.7	.....	2.0	.....	2.3

[a] River was raised by ice gorge December 16 to 27.

Daily gage height, in feet, at Grande Ronde River at Elgin, Oreg., for 1908.

[P. D. Ellis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.30	[a] 2.90	2.50	3.30	4.25	3.10	2.41	1.60	1.49	1.78	1.87	1.85
2	2.30	1.95	2.45	3.30	4.30	3.05	2.38	1.60	1.49	1.77	1.87	1.85
3	2.25	1.90	2.35	3.30	4.30	2.95	2.31	1.58	1.49	1.75	1.86	1.85
4	2.20	1.90	2.35	3.30	4.15	3.01	2.30	1.55	1.49	1.75	1.86	1.85
5	2.20	1.95	2.30	3.35	4.05	2.99	2.27	1.55	1.49	1.75	1.86	1.85
6	2.10	1.95	2.30	3.45	4.00	2.98	2.28	1.55	1.49	1.75	1.86	1.86
7	2.10	2.05	2.25	3.45	4.05	2.98	2.25	1.53	1.49	1.75	1.85	1.86
8	2.05	2.05	2.20	3.40	4.05	2.97	2.15	1.53	1.49	1.76	1.85	1.85
9	2.10	2.05	2.20	3.40	4.00	2.96	2.10	1.52	1.49	1.76	1.85	1.85
10	2.10	2.05	2.25	3.65	3.90	3.15	2.02	1.52	1.50	1.76	1.85	1.86
11	2.10	2.05	2.25	3.90	3.70	3.20	2.00	1.50	1.51	1.77	1.85	1.86
12	2.00	2.00	2.30	4.30	3.65	3.21	1.98	1.50	1.54	1.78	1.85	1.88
13	2.00	[a] 2.30	2.60	4.60	3.45	3.22	1.92	1.50	1.55	1.78	1.86	1.88
14	2.05	2.00	3.10	4.75	3.30	3.23	1.90	1.50	1.55	1.80	1.86	1.88
15	2.00	2.00	4.65	4.85	3.20	3.23	1.90	1.50	1.58	1.85	1.86	1.88
16	2.00	2.05	5.90	4.95	3.35	3.21	1.88	1.50	1.60	1.87	1.86	1.88
17	2.00	2.10	6.10	4.90	3.40	3.15	1.86	1.50	1.65	2.00	1.87	1.88
18	2.00	2.10	6.20	4.90	3.20	3.11	1.86	1.49	1.68	1.98	1.88	1.89
19	2.00	2.10	6.00	5.00	3.25	3.05	1.84	1.49	1.68	1.89	1.88	1.89
20	2.00	2.10	5.35	5.15	3.15	2.98	1.82	1.49	1.70	1.86	1.88	1.89
21	2.00	2.05	4.80	5.20	3.30	2.95	1.80	1.49	1.75	1.83	1.87	1.89
22	2.00	2.05	4.25	5.30	3.30	2.80	1.78	1.49	1.75	1.80	1.87	2.00
23	2.00	2.05	3.95	5.25	3.30	2.82	1.75	1.49	1.74	1.83	1.86	2.00
24	1.95	2.10	3.90	5.00	3.35	2.73	1.71	1.49	1.74	1.87	1.86	2.00
25	1.95	2.30	3.95	4.90	3.35	2.61	1.66	1.49	1.72	1.87	1.85	2.00
26	1.95	2.45	3.95	4.70	3.40	2.57	1.65	1.49	1.73	1.86	1.85	2.00
27	1.95	2.50	3.90	4.50	3.35	2.56	1.64	1.49	1.73	1.86	1.85	2.02
28	1.95	2.50	3.75	4.40	3.30	2.55	1.62	1.49	1.73	1.86	1.85	2.02
29	1.95	2.50	3.60	4.15	3.30	2.55	1.62	1.49	1.76	1.87	1.84	2.02
30	1.95	.....	3.45	4.20	3.25	2.50	1.62	1.49	1.78	1.87	1.84	2.02
31	[a] 2.40	.....	3.40	.....	3.20	.....	1.61	1.49	.....	1.87	.....	2.02

[a] River raised by ice gorge.

Rating table for Grande Ronde River at Elgin, Oreg., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	26	2.90	640	4.40	2,660
1.50	45	3.00	710	4.50	2,840
1.60	67	3.10	790	4.60	3,020
1.70	92	3.20	880	4.70	3,200
1.80	120	3.30	980	4.80	3,380
1.90	150	3.40	1,090	4.90	3,560
2.00	185	3.50	1,210	5.00	3,740
2.10	220	3.60	1,340	5.20	4,100
2.20	260	3.70	1,480	5.40	4,460
2.30	305	3.80	1,630	5.60	4,820
2.40	350	3.90	1,790	5.80	5,200
2.50	400	4.00	1,960	6.00	5,600
2.60	455	4.10	2,130	6.20	6,000
2.70	515	4.20	2,300		
2.80	575	4.30	2,480		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 11 discharge measurements made during 1904–1908, and is well defined between gage heights 1.5 feet and 3.5 feet for 1906, but not well defined for 1907–8.

Monthly discharge of Grande Ronde River at Elgin, Oreg., for 1907 and 1908.

[Drainage area, 1,350 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,560	305	618	0.458	0.53	38,000	C.
February	5,100	1,090	3,360	2.49	2.59	187,000	B.
March	4,280	1,210	2,300	1.70	1.96	141,000	B.
April	6,000	1,960	4,260	3.16	3.53	253,000	B.
May	3,470	2,130	2,930	2.17	2.50	180,000	B.
June	2,220	640	1,270	.941	1.05	75,600	B.
July	675	150	329	.244	.28	20,200	C.
August	150	67	90.6	.067	.08	5,570	C.
September	150	92	138	.102	.11	8,210	C.
October	185	150	155	.115	.13	9,530	C.
November	240	168	197	.146	.16	11,700	C.
December [a]	400	168	238	.176	.20	14,600	C.
The year	6,000	67	1,320	.981	13.12	944,000	
1908.							
January [a]	305	168	203	.150	.17	12,500	C.
February [a]	400	150	224	.166	.18	12,900	C.
March	6,000	260	1,790	1.33	1.53	110,000	C.
April	4,280	980	2,550	1.89	2.11	152,000	B.
May	2,480	835	1,390	1.03	1.19	85,500	B.
June	910	400	688	.510	.57	40,900	B.
July	355	70	171	.127	.15	10,500	C.
August	67	43	47.8	.035	.04	2,940	C.
September	114	43	72.0	.053	.06	4,280	C.
October	185	106	128	.095	.11	7,870	C.
November	144	132	138	.102	.11	8,210	C.
December	192	135	156	.116	.13	9,590	C.
The year	6,000	43	630	.467	6.35	457,000	

[a] Discharges interpolated December 16 to 27, 1907, and January 31 and February 1 and 13, 1908.

GRANDE RONDE RIVER AT ZINDEL, WASH.

This station, which was established June 30, 1904, is located 2 miles above the mouth of the stream, 1½ miles below Joseph Creek. Its records show the quantity of water contributed to Snake River by the Grande Ronde drainage basin.

The data obtained are chiefly of scientific interest in connection with a general study of run-off factors from such forested areas as are found in the Blue Mountains.

The datum of the gage has not been changed since it was installed. The gage height records are complete, but, owing to the inaccessibility of the station, few measurements have been made. The conditions at the station are favorable for the construction of a permanent rating curve, and it is hoped that a sufficient number of ratings can be made in the future to develop this curve and thereby obtain an estimate of the flows for the years covered by gage records.

Daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1907 and 1908.

[M. W. Zindel, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[a]
1907.												
1	4.7	5.05	5.6	5.0	5.1	6.0	4.2	3.2	2.5	2.3	2.45	2.5
2	4.4	4.8	5.4	5.3	5.3	6.0	4.2	3.2	2.65	2.3	2.4	2.5
3	4.3	4.6	5.2	5.4	5.3	5.8	4.9	3.2	2.6	2.3	2.4	2.5
4	4.8	4.3	4.8	5.5	5.4	5.8	5.2	2.9	2.5	2.3	2.4	2.5
5	5.0	4.7	4.8	5.7	5.4	5.3	5.0	2.9	2.5	2.3	2.35	2.5
6	4.7	7.35	4.7	6.0	5.7	5.2	4.9	2.9	2.5	2.3	2.3	2.5
7	4.4	6.8	4.7	6.1	5.8	5.1	4.7	2.9	2.5	2.3	2.3	2.5
8	4.1	6.4	4.7	7.0	5.8	5.1	4.7	2.8	2.4	2.25	2.3	2.5
9	3.9	6.4	4.6	7.1	5.8	5.5	4.5	2.7	2.4	2.25	2.25	2.6
10	3.7	6.2	4.6	7.8	5.8	5.8	4.4	2.7	2.4	2.2	2.25	2.7
11	3.7	6.1	4.6	7.6	6.1	6.0	4.0	2.7	2.5	2.2	2.2	2.8
12	3.7	5.7	4.5	7.15	6.0	5.7	4.0	2.7	2.5	2.2	2.2	2.8
13	3.6	5.5	4.5	7.3	5.8	5.3	4.4	2.6	2.5	2.2	2.3	2.8
14	3.6	5.5	4.45	7.6	5.8	4.8	4.1	2.6	2.4	2.2	2.3	2.75
15	3.4	5.5	4.4	7.6	5.9	4.5	4.0	2.6	2.4	2.2	2.2	2.7
16	3.4	5.4	4.4	7.4	6.0	4.4	4.0	2.6	2.4	2.2	2.2	2.6
17	3.4	5.4	4.2	7.5	6.0	4.4	4.0	2.5	2.4	2.2	2.2	2.7
18	3.4	5.4	4.4	7.3	6.0	4.2	3.8	2.5	2.4	2.2	2.2	2.7
19	3.3	5.3	5.4	7.0	6.1	4.1	3.8	2.4	2.4	2.2	2.2	2.7
20	3.3	5.9	6.45	6.8	6.4	4.0	3.6	2.3	2.4	2.2	2.2	2.8
21	3.3	5.9	7.45	6.4	6.2	4.2	3.6	2.3	2.4	2.2	2.2	3.0
22	3.25	6.0	6.8	6.3	6.2	4.35	3.6	2.3	2.4	2.2	2.2	2.6
23	3.25	6.1	6.4	6.2	6.0	4.4	3.6	2.3	2.4	2.2	2.3	2.85
24	3.0	6.3	6.0	6.1	5.9	4.1	3.6	2.6	2.4	2.2	2.5	3.2
25	3.0	6.6	5.9	6.0	5.6	.....	3.6	2.5	2.4	2.2	2.8	3.7
26	3.0	6.8	5.7	6.0	5.3	4.4	3.5	2.4	2.4	2.2	2.8	4.45
27	2.9	6.9	5.3	5.8	5.3	4.3	3.5	2.5	2.3	2.2	2.7	5.0
28	3.0	6.0	5.0	5.7	5.3	4.9	3.5	2.5	2.3	2.2	2.65	4.3
29	3.3	.....	4.9	5.4	5.3	4.9	3.5	2.5	2.3	2.2	2.6	3.9
30	3.5	.....	5.0	5.3	5.6	4.8	3.4	2.4	2.3	2.2	2.5	3.2
31	3.85	.....	5.0	.....	5.8	.....	3.4	2.4	.....	2.3	.....	3.2
1908.												
1	3.0	2.4	3.3	.....	5.4	4.1	4.2	2.4	2.2	2.2	2.7	2.4
2	3.0	2.4	3.2	.....	5.3	4.1	4.2	2.4	2.3	2.2	2.7	2.4
3	2.9	2.3	3.1	.....	5.3	4.0	4.4	2.3	2.3	2.2	2.7	2.4
4	2.9	2.3	3.0	4.2	5.2	3.8	4.3	2.3	2.3	2.2	2.6	2.4
5	2.7	2.3	3.0	4.3	5.2	3.8	4.1	2.3	2.3	2.2	2.6	2.4
6	2.7	2.5	2.9	4.3	5.1	3.9	4.1	2.3	2.3	2.3	2.6	2.4
7	2.6	2.6	2.9	4.3	5.1	4.0	4.0	2.2	2.2	2.3	2.6	2.4
8	2.5	2.7	2.8	4.2	5.0	4.0	3.9	2.2	2.2	2.4	2.5	2.4
9	2.5	2.7	2.8	4.2	4.8	4.0	3.9	2.2	2.2	2.5	2.5	2.4
10	2.5	2.6	2.9	4.7	4.7	4.6	3.9	2.2	2.2	2.5	2.5	2.4
11	2.5	2.6	3.0	5.3	4.6	5.1	3.8	2.2	2.2	2.6	2.5	2.45
12	2.6	2.5	3.6	5.5	4.7	5.2	3.6	2.2	2.2	2.8	2.5	2.45
13	2.6	2.5	3.9	5.95	5.0	5.25	3.6	2.1	2.2	2.8	2.45	2.45
14	2.6	2.55	5.0	6.0	4.8	5.3	3.5	2.1	2.2	3.0	2.45	2.45
15	2.6	2.6	7.8	6.2	4.6	5.4	3.5	2.1	3.2	3.8	2.4	2.4
16	2.55	2.65	([b])	6.3	4.5	5.6	3.5	2.1	3.0	3.6	2.4	2.4
17	2.5	2.7	.....	6.3	4.3	5.7	3.4	2.0	2.8	3.1	2.4	2.4
18	2.5	2.6	.....	6.0	4.2	6.0	3.3	2.0	2.5	3.0	2.4	2.4
19	2.5	2.6	.....	6.2	4.2	6.0	3.3	2.0	2.4	3.0	2.4	2.2
20	2.8	2.5	.....	6.8	4.2	5.9	3.2	1.9	2.4	2.9	2.4	2.1
21	3.1	2.5	.....	6.8	4.1	5.7	3.1	1.9	2.4	2.9	2.4	2.1
22	2.9	2.6	.....	6.7	4.1	5.3	3.1	1.8	2.4	2.8	2.4	2.0
23	2.7	2.6	.....	6.5	4.1	5.0	3.1	1.8	2.3	2.6	2.4	2.0
24	2.5	2.6	.....	6.4	4.0	4.8	3.0	1.8	2.3	2.5	2.4	2.0
25	2.4	2.8	.....	6.2	4.0	4.4	3.0	1.8	2.2	2.4	2.5	2.0
26	2.4	3.0	.....	5.8	4.1	4.2	2.8	1.9	2.2	2.4	2.5	2.0
27	2.4	3.3	.....	5.7	4.1	4.2	2.8	1.9	2.2	2.4	2.5	2.1
28	2.6	3.35	.....	5.5	4.2	4.1	2.7	1.9	2.2	2.5	2.5	2.1
29	2.6	3.3	.....	5.4	4.3	4.0	2.7	2.0	2.2	2.5	2.5	2.2
30	[c] 2.5	.....	.....	5.4	4.2	4.0	2.6	2.1	2.2	2.6	2.5	2.2
31	2.5	.....	.....	.....	4.2	.....	2.5	2.2	.....	2.6	.....	2.4

[a] River slightly frozen December 17 to 21.
[b] No readings March 16 to April 3; gage was covered with drift.
[c] River partly frozen over.

CATHERINE CREEK NEAR UNION, OREG.

This station, which was established May 15, 1906, is located in a canyon one-half mile below Robbins's sawmill, 6 miles above Union, and above all diversions for irrigation, but below the intake of the water-supply pipe for the city of Union. A small dam about one-fourth mile above the station is used by a mill.

Reliable records obtained at this point would be of great economic importance. The stream has a well-maintained flow throughout the irrigating season, but is nearly all used for irrigation during the summer months. An additional supply is possible only by the construction of storage reservoirs.

During the winter months the water at the station freezes from the bottom, forming anchor ice, and the records during this period of the year are therefore not to be depended upon. During the summer months the flow obtained at the station is more or less irregular, because of the nonuniform use of water at the mill above. As it was impossible to obtain continuous gage observations, the station was abandoned May 19, 1907.

The following measurement was made April 30, 1907.

Width, 39 feet; area, 67 square feet; gage height, 3.20 feet; discharge, 302 second-feet.

WALLOWA RIVER NEAR JOSEPH, OREG.

This station, which was established November 12, 1903, is located 500 feet below the outlet of Wallowa Lake, 1¼ miles above Joseph. Four large irrigation ditches divert a large portion of the stream, the highest one heading about 500 feet below the station. A timber dam at the outlet of Wallowa Lake is jointly owned and operated by the managers of the irrigation ditches.

The data obtained here have practical value in connection with irrigation development and have also scientific interest in connection with the determination of run-off values from the forested areas of the Powder River Mountains.

The bed of the stream is composed of coarse gravel and bowlders and is very rough. Individual measurements of flow can not be made with great accuracy, and changing channel conditions have made it impossible to develop a permanent rating curve. The results thus far obtained are not as accurate as could be desired.

Discharge measurements of Wallowa River near Joseph, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
February 7	W. P. Hardesty	27	32	2.12	84
1908.					
June 2	H. D. McGlashan	38	64	2.68	239
October 19	L. R. Allen	30	39	2.26	114

Daily gage height, in feet, of Wallowa River near Joseph, Oreg., for 1907.

[F. L. Bedingfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	2.15	2.0	2.0	2.1	2.25	.....	3.3	2.9
2	2.15	2.1	2.0	2.1	2.25	.....	3.35	2.9
3	2.1	2.1	2.0	2.1	2.25	.....	3.4	3.0
4	2.1	2.1	2.0	2.1	2.25	.....	3.5	2.9
5	2.1	2.1	2.0	2.1	2.2	.....	3.5	2.95
6	2.1	2.1	2.0	2.1	2.2	.....	3.5	2.9
7	2.1	2.1	2.0	.....	2.2	.....	3.2	3.0
8	2.1	2.1	2.0	2.1	2.25	.....	3.0	2.9
9	2.1	2.1	2.0	2.1	2.2	.....	3.1	2.9
10	2.1	2.1	2.0	2.1	2.2	.....	3.1	2.9
11	.....	2.05	2.0	2.1	2.2	.....	3.1	2.95
12	2.1	2.0	2.0	2.15	2.2	.....	3.35	2.8
13	2.1	2.0	2.0	2.2	2.2	3.2	3.35	2.8
14	2.05	2.0	2.0	.....	2.25	3.1	3.2	2.7
15	2.0	2.0	2.0	2.2	2.25	3.1	3.2	2.7
16	2.0	2.0	2.0	2.2	2.3	2.9	2.9	2.65
17	2.0	2.0	2.05	2.25	2.35	3.0	2.8	2.6
18	2.0	2.0	2.1	.....	2.5	2.8	2.8	2.6
19	2.0	2.0	2.1	2.25	2.4	2.8	2.8	2.6
20	2.0	2.0	2.1	2.3	2.4	2.8	2.9	2.7
21	2.0	2.0	2.15	2.3	2.4	2.9	3.0	2.7
22	2.0	2.0	2.2	2.3	2.4	2.9	3.0	2.7
23	2.0	2.0	2.15	2.3	2.4	2.9	3.0	2.7
24	2.0	2.0	2.15	2.3	2.5	2.9	3.15	.....
25	2.0	2.0	2.15	2.3	2.55	2.95	3.1	.....
26	2.0	2.0	2.15	2.3	2.6	3.0	3.0	.....
27	2.0	2.0	2.1	2.25	2.7	3.1	3.0	.....
28	2.0	2.0	2.1	2.25	2.8	3.25	3.0	.....
29	2.0	.....	2.1	2.25	2.8	3.4	3.0	.....
30	2.0	.....	2.1	2.25	3.0	3.35	3.05	.....
31	2.0	.....	.....	.....	.....	.....	3.0	.....

NOTE.—No ice at this station.

Daily gage heights, in feet, of Wallowa River near Joseph, Oreg., for 1908.

[John Martin, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.15	2.9	2.1	.....	2.1	1.9	16	2.9	3.1	2.7	.....	.....	2.1	2.0
2	.....	3.2	2.9	2.1	.....	2.1	1.9	17	2.92	3.0	2.7	.....	.....	2.1	2.0
3	.....	3.2	2.9	2.1	.....	2.1	1.9	18	2.92	2.9	2.6	.....	.....	2.0	2.0
4	.....	3.2	3.0	2.1	.....	2.1	1.9	19	2.92	2.8	2.6	.....	2.3	2.0	2.0
5	.....	3.2	3.0	2.1	.....	2.1	1.9	20	2.92	2.8	2.6	.....	2.3	2.0	2.0
6	.....	3.2	3.0	2.2	.....	2.1	2.0	21	2.8	2.8	2.5	.....	2.3	2.0	2.0
7	.....	3.2	3.0	2.2	.....	2.1	2.0	22	2.8	2.8	2.5	.....	2.3	2.0	2.0
8	.....	3.2	3.0	2.2	.....	2.1	2.0	23	2.82	2.8	2.5	.....	2.3	2.0	2.0
9	.....	3.2	3.0	2.2	.....	2.1	2.0	24	2.8	2.8	2.4	.....	2.3	2.0	1.9
10	.....	3.2	2.9	2.2	.....	2.1	2.0	25	2.88	2.8	2.4	.....	2.2	2.0	1.9
11	.....	3.3	2.9	2.2	.....	2.1	2.0	26	2.9	2.8	2.4	.....	2.2	2.0	1.9
12	.....	3.3	2.9	.....	.....	2.1	2.0	27	2.9	2.7	2.3	.....	2.2	2.0	1.9
13	.....	3.2	2.9	.....	.....	2.1	2.0	28	3.12	2.7	2.3	.....	2.2	2.0	1.9
14	2.8	3.2	2.8	.....	.....	2.1	2.0	29	3.14	2.7	2.3	.....	2.2	2.0	1.9
15	2.92	3.1	2.8	.....	.....	2.1	2.0	30	3.15	2.8	2.3	.....	2.2	2.0	1.9
								31	.....	2.9	2.2	.....	2.2	.....	1.9

Rating table for Wallowa River near Joseph, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	36	2.40	156	2.90	365	3.40	690
2.00	53	2.50	192	3.00	420	3.50	765
2.10	74	2.60	230	3.10	480		
2.20	98	2.70	270	3.20	545		
2.30	125	2.80	315	3.30	617		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 14 discharge measurements made during 1905–1908 and is fairly well defined between gage heights 2.0 feet and 3.0 feet.

Monthly discharge of Wallowa River near Joseph, Oreg., for 1907 and 1908.

[Drainage area, 47 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	86	53	62.9	1.34	1.54	3,870	C.
February	74	53	60.1	1.28	1.33	3,340	C.
March	98	53	65.5	1.39	1.60	4,030	C.
April	125	74	98.4	2.09	2.33	5,860	B.
May	420	98	167	3.55	4.09	10,300	B.
June 13–30	690	315	440	9.36	6.27	15,700	B.
July	765	315	501	10.7	12.34	30,800	B.
August 1–23	420	230	320	6.81	5.83	14,600	B.
The period						88,500	
1908.							
June 14–30	512	315	378	8.04	5.08	12,700	C.
July	617	270	435	9.26	10.68	26,700	C.
August	420	98	277	5.89	6.79	17,000	C.
September 1–11	98	74	87.1	1.85	.76	1,900	C.
October 19–31	125	98	110	2.34	1.13	2,830	C.
November	74	53	64.9	1.38	1.54	3,860	C.
December	53	36	45.5	.968	1.12	2,800	C.
The period						67,800	

WALLOWA RIVER NEAR WALLOWA, OREG.

This station, which was established November 14, 1903, was abandoned March 31, 1907, as it was impossible to obtain continuous gage observations and as the record did not show the flow of the stream at critical points. It was located one-fourth mile below the mouth of Bear Creek and 1½ miles from Wallowa, in the midst of an irrigated valley. Diversions are numerous above and below this point and a small irrigation ditch diverts water from the right bank about 300 feet above the station. During the winter months the stream is subject to ice conditions which greatly affect the determination of flow.

The following measurement was made May 4, 1907:

Width, 83 feet; area, 150 square feet; gage height, 2.50 feet; discharge, 669 second-feet.

Daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1907.

[A. C. Roop, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.2	2.0	2.3	16	1.8	2.3	2.0
2	2.1	2.1	2.3	17	2.0	2.3	2.0
3	2.1	2.1	2.2	18	2.1	2.3	2.1
4	2.3	2.0	2.2	19	2.0	2.3	2.3
5	2.2	2.4	2.2	20	2.0	2.4	2.5
6	2.0	3.4	2.2	21	1.9	2.4	2.7
7	1.9	2.8	2.2	22	1.9	2.4	2.7
8	1.8	2.6	2.1	23	1.9	2.4	2.6
9	2.0	2.5	2.1	24	1.9	2.4	2.5
10	2.2	2.5	2.1	25	1.9	2.5	2.4
11	2.3	2.4	2.1	26	1.9	2.6	2.4
12	2.1	2.3	2.1	27	1.9	2.5	2.3
13	1.9	2.3	2.1	28	2.0	2.4	2.3
14	1.7	2.3	2.1	29	2.0	.....	2.3
15	1.8	2.3	2.0	30	2.0	.....	2.2
				31	2.0	.....	2.2

NOTE.—The river was about one-quarter frozen over from January 1 to 20. Ice about 2 inches thick. Slush ice ran for 10 or 12 days during this time.

Rating table for Wallowa River near Wallowa, Oreg., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	365	2.30	570	2.70	830	3.10	1,150
2.00	410	2.40	630	2.80	900	3.20	1,240
2.10	460	2.50	690	2.90	980	3.30	1,330
2.20	515	2.60	760	3.00	1,060	3.40	1,420

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on two discharge measurements made in 1906–7 and the form of previous curves and is fairly well defined.

Monthly discharge of Wallowa River near Wallowa, Oreg., for 1907.

[Drainage area, 510 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	570	285	412	0.808	0.93	25,300	C.
February	1,420	410	641	1.26	1.31	35,600	B.
March	830	410	548	1.07	1.23	33,700	B.

WALLOWA RIVER NEAR ELGIN, OREG.

This station, which was established November 18, 1903, is located near Minam station, on the extension of the Elgin branch of the Oregon Railroad and Navigation Company's line just below the mouth of Minam River and 9 miles below the lower end of the Wallowa Valley.

The data are of interest in connection with the determination of run-off factors for areas similar to the Wallowa drainage and will be valuable for water-power developments.

It has been difficult to obtain continuous observations at this point, and the records are therefore somewhat broken. During the winter months ice conditions affect the results to a considerable degree, and the winter records are not as reliable as could be desired. Occasionally ice gorges form below the station, which back the water above the gage. The flow of the stream is, however, fairly uniform.

Discharge measurements of Wallowa River near Elgin, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 2	I. E. Oakes	150	344	3.50	1,520
1908.					
June 3	H. D. McGlashan	142	368	3.42	1,370
October 18	L. R. Allen	135	268	2.83	684

Daily gage height, in feet, of Wallowa River near Elgin, Oreg., for 1907 and 1908.

Day.	1907.[a]									1908.	
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Nov.	Dec.
1	3.3	.....	3.4	3.2	3.3	4.5	4.0	3.2	2.4	.....	2.5
2	3.2	.....	3.3	3.2	3.2	4.4	4.3	3.3	2.4	.....	2.5
3	3.35	.....	3.3	3.3	3.2	5.2	4.1	3.4	2.4	.....	2.6
4	3.45	.....	3.25	3.4	3.1	5.0	4.2	3.3	2.4	.....	2.6
5	3.35	4.5	3.2	3.4	3.1	5.0	4.2	3.3	2.4	.....	2.6
6	3.3	4.2	3.15	3.5	3.0	4.8	4.1	3.2	2.4	.....	2.6
7	3.25	3.9	3.1	3.7	3.5	4.7	4.1	2.9	2.3	.....	2.5
8	3.2	3.6	3.1	3.8	4.0	4.5	4.0	2.9	2.3	.....	2.5
9	3.15	3.6	3.1	4.0	4.2	4.45	3.9	2.8	2.3	.....	2.6
10	3.1	3.6	3.1	4.2	4.25	4.2	3.9	2.9	2.6	.....	2.5
11	3.0	3.55	3.3	4.0	4.3	5.0	3.8	2.8	2.5	.....	2.5
12	3.0	3.5	3.2	4.1	4.2	4.0	3.7	2.8	2.4	.....	2.6
13	2.95	3.4	3.2	4.2	4.2	4.2	3.7	2.8	2.4	.....	2.6
14	2.95	3.4	3.1	4.2	4.1	4.4	3.6	2.8	2.3	.....	2.5
15	7.7	3.5	3.0	4.2	4.0	4.2	3.5	2.8	2.7	.....	2.5
16	8.3	3.6	3.0	4.2	4.5	4.0	3.5	2.7	2.5	2.6	2.5
17	8.4	3.6	2.9	4.0	4.8	4.1	3.4	2.7	2.5	2.6	2.5
18	6.0	3.5	2.9	3.9	4.8	4.1	3.5	2.6	2.5	2.6	2.5
19	4.4	3.5	3.0	3.7	4.75	4.5	3.6	2.6	2.4	2.6	2.5
20	4.35	3.4	3.2	3.7	4.7	4.4	3.5	2.6	2.4	2.6	2.4
21	4.3	3.5	4.5	3.65	4.6	4.2	3.4	2.5	2.5	2.7	2.4
22	4.3	3.5	3.9	3.6	4.5	4.6	3.3	2.5	2.3	2.7	2.4
23	4.3	3.6	3.8	3.6	4.4	4.5	3.2	2.5	2.4	2.7	2.5
24	4.3	3.6	3.6	3.5	4.3	4.3	3.3	2.4	2.5	2.7	2.5
25	4.25	3.7	3.5	3.5	4.4	4.4	3.3	2.3	2.4	2.7	2.5
26	4.25	3.8	3.4	3.45	4.35	4.5	3.3	2.4	2.1	2.6	2.5
27	8.2	3.5	3.3	3.45	4.3	4.6	3.3	2.4	2.2	2.5	2.5
28	.....	3.5	3.3	3.4	4.5	4.9	3.2	2.3	2.2	2.5	2.5
29	.....	.....	3.2	3.4	4.5	4.5	3.4	2.4	.....	2.5	2.4
30	.....	.....	3.1	3.35	4.5	4.4	3.5	2.4	.....	2.6	2.4
31	.....	.....	3.1	.....	4.7	.....	3.6	2.5	.....	.....	2.4

[a] Ice conditions for 1907 as follows: First freeze January 4, depth of ice 4 inches. This ice went out January 15 and formed an ice gorge which caused the high gage height on this date. From January 27 to February 5 the river was frozen about two-thirds over and solid about the gage.

Rating table for Wallowa River near Elgin, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	255	2.90	780	3.70	1,755	4.50	3,100
2.20	300	3.00	870	3.80	1,905	4.60	3,300
2.30	350	3.10	970	3.90	2,060	4.70	3,500
2.40	405	3.20	1,080	4.00	2,220	4.80	3,700
2.50	470	3.30	1,200	4.10	2,385	4.90	3,920
2.60	540	3.40	1,330	4.20	2,555	5.00	4,140
2.70	615	3.50	1,470	4.30	2,730	5.10	4,370
2.80	695	3.60	1,610	4.40	2,910	5.20	4,600

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 15 discharge measurements made during 1903–1908, and is fairly well defined between gage heights 2.2 feet and 4.2 feet.

Monthly discharge of Wallowa River near Elgin, Oreg., for 1907 and 1908.

[Drainage area, 870 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 5–28	3,100	1,330	1,660	1.91	1.70	79,100	B.
March	3,100	780	1,200	1.38	1.59	73,800	B.
April	2,560	1,080	1,770	2.03	2.26	105,000	B.
May	3,700	870	2,530	2.91	3.36	156,000	B.
June	4,600	2,220	3,100	3.56	3.97	184,000	B.
July	2,730	1,080	1,720	1.98	2.28	106,000	B.
August	1,330	350	679	.780	.90	41,800	B.
September	615	255	401	.461	.51	23,900	B.
The period						770,000	
1908.							
November 16–30	615	470	551	.633	.35	16,400	C.
December	540	405	473	.544	.63	29,100	C.
The period						45,500	

PALOUSE RIVER BASIN.

DESCRIPTION.

Palouse River rises in the northern part of Lattah County, Idaho, on the divide between the Spokane and Snake River drainage, flows west and then south, and discharges into Snake River in the southwest corner of Whitman County, Wash. The drainage area comprises 2,310 square miles, and at Winona measures 1,120 square miles.

The surface is in general rolling and in some places is rough and broken. The average elevation at the headwaters of the stream is 3,000 feet above sea level; the elevation at Colfax is 1,974 feet.

The principal tributary of the Palouse is Rock Creek, which drains a number of small lakes in the northern part of Whitman County. The agricultural lands consist chiefly of rolling table-lands, largely utilized for the production of wheat. No forests of magnitude are

found on the drainage area and such as do exist are of the small black pines near the headwaters of the stream.

The mean annual rainfall is about 20 inches, much of which falls during the winter months in the form of snow.

The area is well adapted to irrigation agriculture, although the present development in that direction is restricted to the small areas contiguous to the streams where irrigation by individual or small company ditches is possible. A number of projects of magnitude have been contemplated, involving the storage of waters from the main stream and its tributaries in some of the storage sites which are found in this area. These sites are in the form of long canyons, called coulées, usually dry. Dams constructed at the outlets of such coulées will develop storage reservoirs of great capacity, but unfortunately the water must be supplied by artificial channels as the drainage area above them is usually insufficient to insure an adequate water supply. The soil of the country is well adapted to all kinds of products possible through irrigated agriculture.

The year 1905 is the "dry year" of the records and 1901 the "wet year."

The following gaging stations have been developed in this drainage basin:

Palouse River at Hooper (1897 to 1908).
Palouse River at Elberton (1904 to 1905).
Cow Creek at Hooper (1904).
Cow Creek at Keystone (1904 to 1905).
Rock Creek near St. Johns (1903 to 1905).

PALOUSE RIVER AT HOOPER, WASH.

This station, which was established April 1, 1897, is located 1 mile above the mouth of Cow Creek.

The data obtained at this point are of value as indicating the amount of water available for irrigation on the lands of the Washtucna Valley and the territory to the north of Pasco. As the low water flow is comparatively small, any development for irrigation must involve the construction of storage reservoirs. A number of sites were under consideration when the Palouse project was investigated by the United States Reclamation Service.

The conditions at the station are favorable for good results. During the winter months there is little or no interference from ice, so that continuous records have been possible when gage observers were available. From April 21, 1907, to June 14, 1908, no observations were taken, but as this period did not include critical stages of the river, and as the records cover a long period, the omission is not as serious as it might be. The datum of the present gage is 1,053.42 feet above sea level.

Discharge measurements of Palouse River at Hooper, Wash., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 7	H. D. McGlashan	106	564	6.45	2,520
April 25	do	94	350	4.37	1,000
1908.					
October 4 [a]	L. R. Allen	68	59	.97	34

[a] Made with defective meter; discarded.

Daily gage height, in feet, of Palouse River at Hooper, Wash., for 1907 and 1908.

Day.	1907.[a]				1908.[b]						
	Jan.	Feb.	Mar.	Apr.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.8	5.6	8.9	6.1	.....	1.48	0.72	0.70	0.79	1.24	1.30
2	6.4	5.1	8.6	6.1	.....	1.45	.67	.70	.95	1.24	1.25
3	5.4	5.6	7.7	6.7	.....	1.48	.64	.69	1.10	1.17	1.25
4	5.6	5.5	7.2	6.6	.....	1.45	.62	.70	1.00	1.14	1.24
5	6.7	5.4	6.9	6.4	.....	1.40	.65	.68	.95	1.13	1.24
6	7.0	5.5	6.7	6.5	.....	1.37	.78	.67	.93	1.30	1.40
7	6.6	5.75	6.3	7.3	.....	1.30	.80	.67	.93	1.41	1.30
8	5.8	7.8	5.85	7.0	.....	1.30	.80	.67	.95	1.38	1.35
9	5.0	10.6	6.35	6.7	.....	1.20	.77	.66	.93	1.30	1.35
10	4.5	11.7	6.5	6.5	.....	1.20	.77	.66	.90	1.20	1.47
11	4.4	10.9	6.5	6.7	.....	1.20	.80	.66	.90	1.16	1.40
12	4.3	10.6	7.2	6.8	.....	1.19	.77	.65	.93	1.10	1.39
13	4.2	9.3	7.3	6.9	.....	1.18	.81	.68	.95	1.12	1.40
14	4.0	8.7	7.1	6.7	2.35	1.18	.81	.68	.93	1.13	1.39
15	3.8	8.0	6.6	6.4	2.28	1.65	.80	.68	.94	1.13	1.40
16	3.75	7.7	6.5	6.5	2.17	1.22	.80	.70	.99	1.14	1.45
17	3.7	7.6	6.2	6.5	2.10	1.18	.80	.72	1.05	1.16	1.25
18	3.7	7.5	6.05	6.2	1.90	1.00	.78	.73	1.06	1.19	1.25
19	3.75	7.5	6.9	5.9	1.80	1.00	.78	.74	1.06	1.20	1.25
20	3.8	9.6	7.05	5.4	1.80	.85	.76	.72	1.25	1.20	1.25
21	3.9	9.8	7.9	.....	1.95	.78	.76	.72	1.35	1.22	1.30
22	4.5	9.8	9.7	.....	1.95	.70	.70	.73	1.43	1.20	1.25
23	4.35	9.7	10.0	.....	1.80	.72	.70	.73	1.45	1.20	1.25
24	4.3	9.5	9.9	.....	1.70	.72	.70	.73	1.30	1.19	1.25
25	4.15	9.4	9.6	.....	1.75	.72	.68	.74	1.25	1.18	1.25
26	4.1	10.3	9.1	.....	1.90	.72	.71	.75	1.25	1.50	1.24
27	3.9	11.0	8.2	.....	1.65	.70	.71	.76	1.24	1.47	1.25
28	3.6	10.4	7.7	.....	1.60	.71	.71	.78	1.18	1.37	1.31
29	3.4	.....	7.05	.....	1.55	.72	.71	.78	1.15	1.25	1.60
30	3.35	.....	6.7	.....	1.64	.75	.71	.79	1.25	1.32	1.65
31	3.5	.....	6.4	.....	.....	.73	.70	.....	1.15	.....	1.90

[a] Frank Hill, observer.

[b] Mrs. L. C. Huffman, observer.

Rating table for Palouse River at Hooper, Wash., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	19	2.00	195	3.40	575	5.60	1,800
.70	24	2.10	217	3.50	610	5.80	1,955
.80	30	2.20	240	3.60	650	6.00	2,120
.90	36	2.30	263	3.70	690	6.20	2,290
1.00	44	2.40	287	3.80	730	6.40	2,470
1.10	52	2.50	312	3.90	770	6.60	2,650
1.20	62	2.60	337	4.00	815	6.80	2,840
1.30	74	2.70	363	4.20	915	7.00	3,030
1.40	88	2.80	391	4.40	1,020	8.00	4,030
1.50	102	2.90	420	4.60	1,135	9.00	5,150
1.60	118	3.00	450	4.80	1,255	10.00	6,500
1.70	136	3.10	480	5.00	1,380	11.00	8,150
1.80	154	3.20	510	5.20	1,510	12.00	9,900
1.90	174	3.30	540	5.40	1,650		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1905–1907 and the form of the 1904 curve, and is fairly well defined.

Monthly discharge of Palouse River at Hooper, Wash., for 1906 to 1908.

[Drainage area, 2,210 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.[a]							
January	915	102	319	0.144	0.17	19,600	B.
February	2,420	363	878	.397	.41	48,800	B.
March	2,470	435	964	.436	.50	59,300	B.
April	2,120	420	943	.427	.48	56,100	B.
May	730	136	253	.114	.13	15,600	B.
June	690	118	279	.126	.14	16,600	B.
July	136	40	74.8	.034	.04	4,600	B.
August	36	24	27.4	.012	.01	1,680	B.
September	30	30	30.0	.014	.02	1,790	B.
October	40	30	34.1	.015	.02	2,100	B.
November	1,020	36	235	.106	.12	14,000	B.
December	6,200	102	1,470	.665	.77	90,400	B.
The year	6,200	24	459	.208	2.81	331,000	
1907.							
January	3,030	558	1,240	.561	.65	76,200	B.
February	9,360	1,440	4,820	2.18	2.27	268,000	B.
March	6,500	2,000	3,550	1.61	1.86	218,000	B.
April 1–20	3,330	1,650	2,570	1.16	.86	102,000	B.
The period						664,000	
1908.							
June 14–30	275	110	172	.078	.05	5,800	B.
July	127	24	55.7	.025	.03	3,420	B.
August	31	20	26.5	.012	.01	1,630	B.
September	29	22	24.6	.011	.01	1,460	B.
October	95	29	52.6	.024	.03	3,230	B.
November	102	52	66.6	.030	.03	3,960	B.
December	174	67	82.1	.037	.04	5,050	B.
The period						24,600	

[a] These values supersede those published in Water-Supply Paper No. 214, p. 121.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Snake River drainage basin, in Washington and Oregon, during 1907 and 1908:

Miscellaneous measurements in Snake River basin in Washington and Oregon in 1907–8.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
August 1, 1908	North Fork of Snake River.	Snake River	Rexburg, Idaho, bridge.		815
August 4, 1908	do	do	do		644
August 12, 1908	do	do	do		572
September 22, 1908	Boise River	do	Interburban Bridge, near Caldwell, Idaho.		362
July 12, 1908	Middle Fork of Malheur River.	Malheur River	Warm Spring ranch, Oreg.		41
July 11, 1908	do	do	Drewsey, Oreg.		40
August 6, 1907	Spring	South Fork of Malheur River.	Chris Dennaen's sec. 2, T. 25 S., R. 36 E, Oreg.		4.0
July 11, 1908	North Fork of Malheur River.	Malheur River	Beulah, Oreg.		50
April 26, 1907	Bully Creek	do	Vale, Oreg.	4.75	59
July 10, 1908	Mill ditch	do	Vale, Oreg., near intake.		20
July 4, 1907	Burnt River	Snake River	Durkee, Oreg.		23
July 3, 1907	South Fork of Dixie Creek.	Burnt River	Rye Valley, Oreg., 4 miles above mouth.		1.5
August 22, 1907	Grande Ronde River.	do	La Grande, Oreg.		10
May 31, 1908	Fivepoint Creek	Grande Ronde River	Hilgard, Oreg., near mouth.	[a]—6.55	47
February 6, 1907	Wallowa River	do	Junction of forks, Oregon.		48
June 2, 1908	do	do	Lovely, Oreg., above Minam River.	[b,c]—.82	626
September 1, 1907	do	do	do	[b,c]—1.00	666
May 5, 1907	do	do	do	([b])	864
March 3, 1907	do	do	do	([b])	777
February 17, 1907	do	do	do	([b])	1,010
June 3, 1908[d]	Minam River	do	Lovely, Oreg.		744
September 1, 1907[d]	do	do	do		187
March 3, 1907[d]	do	do	do		684
February 17, 1907[d]	do	do	do		608
June 2, 1908	Silver Lake canal.	do	Joseph, Oreg., one-half mile below intake.		47
Do	Granger canal	do	Joseph, Oreg., at bridge at planing mill.	1.50	71
Do	Mitchell canal	do	Joseph, Oreg., in flume	1.40	33
Do	Big Bend canal	do	Joseph, Oreg., bridge near planing mill.	.40	32
September 1, 1908	Asotin Creek	Snake River	Shellman's ranch 8 miles above Asotin.	1.05	38
April 25, 1907	Cow Creek	Palouse River	Hooper, Wash., 1 mile above mouth.	5.30	117

[a] Below the top of the highway bridge floor, upstream side, at a point 23 feet from the right end of floor.
[b] Gaged at footbridge just below Canyon stage station and above mouth of Minam Creek.
[c] Below a small ledge of projecting rock on the right bank, 9.0 feet vertically underneath a point on the top of the downstream log of the footbridge, 7.5 from the right end of the log.
[d] The discharge of this stream is obtained by taking the difference of the discharges of the Wallowa River above and below its mouth.

WALLA WALLA RIVER DRAINAGE BASIN.

DESCRIPTION.

Walla Walla River rises on the western slope of the Blue Mountains and flows westward into the Columbia. Its drainage area lies immediately north of that of the Umatilla and is in many respects similar.

Altitudes within the basin range from 5,000 feet on the headwaters to 1,000 feet near Walla Walla. The mean annual rainfall ranges from 30 inches in the upper portion to 12 in the lower portion of the area. Only the upper part of the drainage area is forested, and that in the manner characteristic of the Blue Mountains. The lower half is given to the production of wheat without irrigation, while the lands contiguous to the streams are extensively irrigated.

Climate and soil combine to make the country wonderfully productive, and the agricultural products range from the hardier forage crops to fancy fruits.

On the headwaters of the stream very favorable opportunities for the development of water power and storage facilities are found which, if developed, would more than double the value of this stream. The entire low-water flow of the river is appropriated many times for irrigation, and the only solution to a situation that has been aggravated in the extreme and promises to become even more critical as additional areas are irrigated lies in the construction of storage reservoirs.

The conditions for obtaining reliable records of stream flow are not good. The river throughout is swift, and the bed is composed of gravel that changes with every freshet, thus making a permanent rating impossible. On this account the records are incomplete and usually cover the period between floods. Floods on this stream are caused suddenly by "Chinook" winds that melt the snows on the headwaters. Some of these floods have been exceedingly harmful, rendering large areas of fine farm lands worthless and causing great damage to life and property.

The following gaging stations have been maintained in this river basin:

Walla Walla River at Whitman, Wash. (1897 to 1899).
Walla Walla River near Milton, Oreg. (1903 to 1908).
South Fork of Walla Walla River near Milton, Oreg. (1903 to 1908).

WALLA WALLA RIVER NEAR MILTON, OREG.

The records for this station begin February 14, 1903, but they are not continuous. The station has been located at various points from the town of Milton to the Jewel West bridge, 3 miles above, where a station was established August 16, 1906. Owing to lack of observers, however, the records are not continuous even at this point. A small ditch diverts water from the river just above the station.

It has been impossible to find a point where the records would not be complicated by diversions for irrigation, as the waters of the stream are appropriated many times over during the summer.

The stream bed is composed of coarse gravel, and as the river is subject to violent floods a permanent rating curve has not been constructed; instead it has been practicable to obtain results only between floods. A number of gages and gaging equipments have been washed away during these excessive floods, and at such times the aspect of the river undergoes a great change.

As a result of a flood which occurred May 30, 1906, new channels were formed in many places.

Discharge measurements of Walla Walla River near Milton, Oreg., in 1906 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 29	P. A. Cupper	43	52	1.63	97
December 11	H. D. McGlashan	63	72	2.20	300
1908.					
October 15	L. R. Allen	110	130	1.61	185

Daily gage height, in feet, of Walla Walla River near Milton, Oreg., for 1907 and 1908.

Day.	1907.[a]						1908.[b]		
	Jan.[c]	Feb.	Mar.	Apr.	May.	June.	Oct.	Nov.	Dec.
1	1.7	2.75	2.55	2.20	1.7	1.6	.....	1.65	1.55
2	1.7	2.65	2.4	1.95	1.7	1.55	.....	1.65	1.55
3	1.75	2.6	2.3	1.95	1.65	1.55	.....	1.65	1.55
4	1.65	2.5	2.2	2.0	1.65	1.55	.....	1.65	1.55
5	1.65	2.55	2.1	1.95	1.65	1.5	.....	1.65	1.55
6	1.6	2.9	2.1	1.95	1.7	1.5	.....	1.65	1.55
7	1.6	3.0	2.2	1.9	1.75	1.55	.....	1.65	1.55
8	1.55	2.8	2.1	2.0	1.8	1.55	.....	1.65	1.55
9	1.5	2.75	2.1	2.3	1.85	1.6	.....	1.65	1.55
10	1.45	2.7	2.3	2.4	1.9	1.6	.....	1.65	1.55
11	1.55	2.6	2.2	2.3	1.9	1.6	.....	1.65	1.6
12	1.5	2.65	2.1	2.0	1.9	1.65	.....	1.65	1.55
13	1.65	2.5	2.0	2.0	1.8	1.7	.....	1.65	1.55
14	1.4	2.55	2.1	2.0	1.8	1.65	.....	1.65	1.55
15	1.5	2.4	2.5	2.0	1.85	1.65	1.65	1.65	1.55
16	1.55	2.3	2.0	1.95	1.85	.....	1.7	1.65	1.55
17	1.9	2.3	2.2	1.95	1.85	.....	1.75	1.65	1.5
18	1.85	2.4	2.3	1.9	1.85	.....	1.6	1.65	1.5
19	2.4	2.4	2.4	1.9	1.8	.....	1.55	1.65	1.5
20	2.6	2.5	2.6	1.85	1.8	.....	1.55	1.65	1.5
21	2.55	2.55	2.5	1.85	1.75	.....	1.55	1.65	1.5
22	2.6	2.55	2.3	1.85	1.75	.....	1.55	1.65	1.5
23	2.75	2.65	2.2	1.8	1.7	.....	1.55	1.65	1.5
24	2.75	2.6	2.2	1.8	1.7	.....	1.55	1.65	1.5
25	2.7	2.5	2.1	1.75	1.65	.....	1.55	1.65	1.5
26	2.7	2.55	2.1	1.7	1.65	.....	1.55	1.65	1.5
27	2.75	2.65	2.0	1.7	1.65	.....	1.55	1.65	1.5
28	2.7	2.5	1.95	1.7	1.6	.....	1.55	1.7	1.5
29	2.6	.....	1.9	1.75	1.6	.....	1.55	1.65	1.5
30	2.55	.....	1.95	1.75	1.6	.....	1.55	1.65	1.5
31	2.7	.....	1.95	.....	1.6	.....	1.55	.....	1.5

[a] Maud Osborn, observer. [b] Arthur Walden, observer. [c] River frozen from January 28 to 31.

Rating table for Walla Walla River near Milton, Oreg., for September 1, 1906, to June 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	35	2.00	218	2.70	570	3.40	1,050
1.40	50	2.10	256	2.80	635	3.50	1,130
1.50	68	2.20	300	2.90	700	3.60	1,210
1.60	90	2.30	348	3.00	770	3.70	1,290
1.70	118	2.40	398	3.10	840	3.80	1,370
1.80	150	2.50	450	3.20	910	3.90	1,450
1.90	182	2.60	508	3.30	980	4.00	1,530

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 2 discharge measurements made during 1906, and is well defined between gage heights 1.6 feet and 2.2 feet.

Monthly discharge of Walla Walla River near Milton, Oreg., for 1906 and 1907.

[Drainage area, 130 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	349	144	221	1.70	1.96	13,600	A.
February	406	150	239	1.84	1.92	13,300	A.
March	482	175	260	2.00	2.31	16,000	A.
April	469	307	384	2.95	3.29	22,800	A.
May 1-29	1,370	175	274	2.11	2.28	15,800	A.
September	166	42	112	.862	.96	6,660	A.
October	166	104	128	.985	1.14	7,870	A.
November	1,250	104	357	2.75	3.07	21,200	B.
December	1,530	166	449	3.45	3.98	27,600	B.
The period						145,000	
1907.							
January	602	50	281	2.16	2.49	17,300	B.
February	770	348	503	3.87	4.03	27,900	B.
March	508	182	302	2.32	2.68	18,600	B.
April	398	118	200	1.54	1.72	11,900	B.
May	182	90	132	1.02	1.18	8,120	B.
June 1-15	118	68	82.8	.637	.36	2,460	C.
The period						86,300	

SOUTH FORK OF WALLA WALLA RIVER NEAR MILTON, OREG.

This station was originally established February 15, 1903, 1 mile above the mouth of the river and 7 miles from Milton.

The flood of May 30, 1906, changed the channel of the river and left the gage high and dry. On August 10 of that year a new station was established one-fourth mile above the headgate of the Northwest Gas and Electric Company's pipe line in the canyon 12 miles from Milton. It is above all diversions for irrigation.

The data obtained at this station are of considerable value in connection with both water power and irrigation, and they also furnish some interesting information concerning the run-off from small forested drainage areas under the climatic conditions that obtain in

the Blue Mountains. The stream is fed by springs and the flow is well maintained, although subject to violent floods.

The conditions at this station are not permanent, and a new rating curve will be required after each large flood. Since the station was established one gage has been washed away and the records were interrupted from March 14, 1908, to October 14, 1908, when a new gage was installed at the same point and datum as the old. Individual measurements can be made with accuracy, but an insufficient number of measurements between floods will make estimates correspondingly inaccurate. The highest discharge recorded since the station was established is 1,660 second-feet, April 14, 1904, but this value, however, does not nearly represent the flood discharge at this point. For low-water conditions the records obtained prior to August 10, 1906, are not comparable with those obtained afterwards, because the water is largely diverted for irrigation in small ditches before reaching the lower station. A considerable portion of this water is undoubtedly returned to the stream, but there are also some contributions from intermediate drainage.

Discharge measurements of South Fork of Walla Walla River near Milton, Oreg., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 10	J. C. Stevens	45	49	2.50	120
December 13	H. D. McGlashan	42	56	3.73	183
1907.					
September 11	E. F. Kriegsman	35	43	3.00	118
1908.					
October 14	Allen and George	40	51	2.86	161

NOTE.—Measurements made by wading.

Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for 1907 and 1908.

[John Munson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.5	3.5	3.5	3.4	3.5	3.3	3.0	3.0	3.0	3.0	3.1	3.2
2	3.5	3.35	3.4	3.4	3.5	3.3	3.0	3.0	3.0	3.0	3.1	3.2
3	3.5	3.3	3.4	3.4	3.5	3.3	3.0	3.0	3.0	3.0	3.1	3.1
4	3.5	3.35	3.4	3.4	3.6	3.3	3.0	3.0	3.0	3.0	3.1	3.1
5	3.5	3.7	3.4	3.4	3.6	3.2	3.0	3.0	3.0	3.0	3.1	3.1
6	3.4	3.9	3.4	3.45	3.6	3.2	3.0	3.0	3.0	3.0	3.1	3.1
7	3.4	3.7	3.3	3.6	3.6	3.2	3.0	3.0	3.0	3.0	3.1	3.3
8	3.3	3.7	3.3	3.75	3.7	3.2	3.0	3.0	3.0	3.0	3.1	3.3
9	3.3	3.7	3.3	3.95	3.7	3.2	3.0	3.0	3.0	3.0	3.1	3.2
10	3.3	3.7	3.3	3.95	3.7	3.2	3.0	3.0	3.0	3.0	3.1	3.2
11	3.3	3.7	3.3	3.85	3.6	3.2	3.0	3.0	3.0	3.0	3.1	3.2
12	3.2	3.55	3.3	3.65	3.6	3.2	3.0	3.0	3.0	3.0	3.1	3.2
13	3.2	3.5	3.2	3.65	3.5	3.2	3.0	3.0	3.0	3.0	3.1	3.3
14	3.2	3.5	3.2	3.8	3.5	3.2	3.0	3.0	3.0	3.0	3.1	3.3
15	3.2	3.5	3.2	3.7	3.5	3.1	3.0	3.0	3.0	3.0	3.1	3.2

Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.1	3.4	3.2	3.7	3.5	3.1	3.0	3.0	3.1	3.0	3.1	3.2
17	3.2	3.5	3.25	3.6	3.65	3.1	3.0	3.0	3.1	3.0	3.1	3.2
18	3.2	3.45	3.4	3.5	3.8	3.1	3.0	3.0	3.1	3.0	3.1	3.2
19	3.1	3.4	3.5	3.5	3.7	3.1	3.0	3.0	3.0	3.0	3.1	3.1
20	3.1	3.75	3.9	3.5	3.7	3.1	3.0	3.0	3.0	3.0	3.1	3.15
21	3.1	3.75	3.75	3.5	3.6	3.1	3.0	3.0	3.0	3.0	3.1	3.3
22	3.1	3.7	3.6	3.5	3.6	3.1	3.0	3.0	3.0	3.0	3.2	3.3
23	3.1	3.7	3.5	3.5	3.5	3.2	3.0	3.0	3.0	3.0	3.3	3.3
24	3.1	3.75	3.45	3.5	3.5	3.1	3.0	3.0	3.0	3.0	3.45	3.6
25	3.3	3.9	3.4	3.5	3.5	3.1	3.0	3.0	3.0	3.0	3.35	3.45
26	3.3	3.8	3.4	3.5	3.4	3.1	3.0	3.0	3.0	3.0	3.3	3.75
27	3.1	3.65	3.4	3.5	3.4	3.1	3.0	3.0	3.0	3.0	3.2	3.55
28	3.1	3.65	3.3	3.5	3.4	3.1	3.0	3.0	3.0	3.0	3.2	3.35
29	3.1	.....	3.3	3.5	3.4	3.1	3.0	3.0	3.0	3.0	3.2	3.3
30	3.1	.....	3.4	3.4	3.4	3.1	3.0	3.0	3.0	3.0	3.2	3.3
31	3.4	.....	3.45	.....	3.4	.....	3.0	3.0	.....	3.1	.....	3.3

Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Oct.	Nov.	Dec.
1908.							1908.						
1	3.2	3.1	3.2	.....	2.8	2.7	16	3.1	3.1	.....	2.75	2.7	2.7
2	3.2	3.1	3.2	.....	2.8	2.7	17	3.1	3.2	.....	2.7	2.7	2.7
3	3.2	3.1	3.2	.....	2.8	2.7	18	3.1	3.2	.....	2.7	2.7	2.7
4	3.2	3.1	3.2	.....	2.8	2.7	19	3.2	3.2	.....	2.8	2.7	2.7
5	3.2	3.1	3.2	.....	2.7	2.7	20	3.2	3.2	.....	2.9	2.7	2.7
6	3.2	3.1	3.1	.....	2.7	2.7	21	3.2	3.2	.....	2.8	2.7	2.7
7	3.2	3.1	3.1	.....	2.7	2.7	22	3.2	3.2	.....	2.7	2.7	2.7
8	3.2	3.1	3.1	.....	2.7	2.7	23	3.2	3.2	.....	2.7	2.9	2.7
9	3.2	3.1	3.1	.....	2.7	2.7	24	3.2	3.2	.....	2.7	2.9	2.7
10	3.2	3.1	3.1	.....	2.7	2.7	25	3.2	3.2	.....	2.8	2.85	2.7
11	3.2	3.1	3.2	.....	2.7	2.7	26	3.2	3.2	.....	2.8	2.8	2.7
12	3.2	3.1	3.3	.....	2.7	2.7	27	3.2	3.3	.....	2.8	2.8	2.7
13	3.2	3.1	3.45	.....	2.7	2.7	28	3.15	3.3	.....	2.8	2.75	2.7
14	3.1	3.1	3.6	2.9	2.7	2.7	29	3.1	3.3	.....	2.8	2.7	2.7
15	3.1	3.1	.....	2.8	2.7	2.7	30	3.1	.....	.....	2.8	2.7	2.7
							31	3.1	.....	.....	2.8	.....	2.7

Rating tables for South Fork of Walla Walla River near Milton, Oreg.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
August 10 to September 15, 1906 [a]	2.50	120
	2.60	128
January 1, 1907, to March 14, 1908 [b]	3.00	118
	3.10	126
	3.20	134
	3.30	143
	3.40	152
	3.50	161
	3.60	170
	3.70	179
	3.80	188
	3.90	197
October 14 to December 31, 1908 [c]	2.70	148
	2.80	156
	2.90	165

[a] Not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1906 and form of the 1907 curve and is well defined,

[b] Not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1906–7 and is well defined.

[c] Not applicable for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908 and the form of the 1907 curve and is well defined.

Monthly discharge of South Fork of Walla Walla River near Milton, Oreg., for 1906 to 1908.

[Drainage area, 72 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total, in acre-feet.	
1906.							
August 10–31	126	120	122	1.69	1.38	5,320	A.
September 1–15	125	120	121	1.68	.94	3,600	A.
1907.							
January	161	126	139	1.93	2.22	8,550	A.
February	197	143	171	2.38	2.48	9,500	A.
March	197	134	151	2.10	2.42	9,280	A.
April	202	152	167	2.32	2.59	9,940	A.
May	188	152	166	2.31	2.66	10,200	A.
June	143	126	131	1.82	2.03	7,800	A.
July	118	118	118	1.64	1.89	7,260	A.
August	118	118	118	1.64	1.89	7,260	A.
September	126	118	119	1.65	1.84	7,080	A.
October	126	118	118	1.64	1.89	7,260	A.
November	156	126	130	1.81	2.02	7,740	A.
December	184	126	140	1.94	2.24	8,610	A.
The year	202	118	139	1.93	26.17	100,000	
1908.							
January	134	126	132	1.83	2.11	8,120	B.
February	143	126	131	1.82	1.96	7,540	B.
March 1–14	170	126	136	1.89	.98	3,780	B.
October 14–31	165	148	155	2.15	1.44	5,530	A.
November	165	148	151	2.10	2.34	8,980	A.
December	148	148	148	2.06	2.38	9,100	A.

UMATILLA RIVER DRAINAGE BASIN.

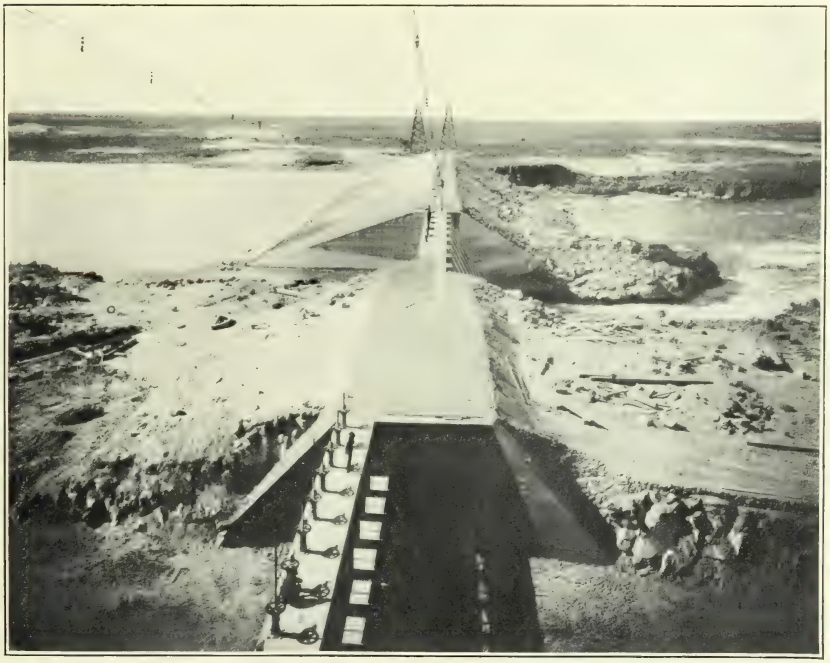
DESCRIPTION.

Umatilla River rises in the northeastern corner of Umatilla County, Oreg., and flows generally westward a distance of 80 miles, emptying into Columbia River at the town of Umatilla. The area above the town of Pendleton spreads out in fan shape, including the western slope of the Blue Mountains for a distance of about 70 miles.

The principal tributaries are Birch, McKay, and Meachum creeks. The drainage area measures 2,130 square miles at the mouth of the river, 640 square miles at Pendleton, and 353 square miles at Gibbon.

The mean annual rainfall ranges from about 30 inches on the summit of the Blue Mountains to 9 inches at the mouth of the stream, being 14 inches at Pendleton and 25 inches at Weston on the divide between Umatilla and Walla Walla rivers. The headwater regions of the stream are quite heavily forested, but downstream the forests give place to rolling table-lands devoted to the production of wheat. The immediate valley of the river has been irrigated for many years, and the entire low-water flow of the stream is appropriated for irrigation. The United States Reclamation Service has completed a project to irrigate about 20,000 acres near Hermiston (Pl. VII, *A*). The soil of this portion of the drainage basin is sandy and the climatic

A. FURNAS RANCH, NEAR HERMISTON, OREG., UMATILLA PROJECT.



B. MINIDOKA DAM AND REGULATING DEVICES.

conditions are favorable for the production of fruit. The highest run-off obtained since records have been kept occurred in 1899 and the lowest in 1906.

The following gaging stations have been maintained in this drainage basin:

Umatilla River near Umatilla (1904 to 1908).
Umatilla River at Yoakum (1903 to 1908).
Umatilla River at Pendleton (1891 to 1892 and 1903 to 1905).
Umatilla River at Gibbon (1896 to 1908).
McKay Creek near Pendleton (1903 to 1904).

UMATILLA RIVER AT GIBBON, OREG.

This station was established July 22, 1896, and has been maintained continuously since that date except for certain intervals when an observer was not available or when the gage equipment had been washed away by flood. The records of the flow at this station are of particular value, as the waters are entirely used in the lower valleys for irrigation, and at this point the river affords some exceptional advantages for water-power development. The station is located on the Umatilla Indian Reservation, 1 mile below Gibbon post-office, about 1½ miles below the mouth of Meacham Creek, and 2 miles above the mouth of Squaw Creek.

The river here is subject to sudden and violent floods, and it has been impossible to establish a permanent rating curve. The bed of the stream throughout its course is composed of coarse gravel, and the river has a flood plain from 100 to 500 feet in width. When these floods occur, the appearance of the locality is changed almost beyond recognition. Gage after gage has been washed away and a number of gaging cables have been destroyed. Under such conditions the maintenance of a permanent gage datum is of no consequence and the station has to be rerated after each destructive flood. The actual quantity of water carried at the crest of the flood at such times can not be determined, because the maximum change in the channel is then taking place.

For the reasons above stated the records at the station have been intermittent, but estimates of the flow during the interval of interruption have been made, either from the facts obtained from local authorities or by comparison with other stations farther down stream, whenever it could be done with a reasonable degree of accuracy.

Discharge measurements of Umatilla River at Gibbon, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
September 12 [a]	E. F. Kriegsman	58	32	0.72	65
1908.					
March 20	J. C. Stevens	108	282	2.33	1,530
June 6	H. D. McGlashan	98	93	.80	269
October 16	L. R. Allen	101	53	.32	120

[a] Measured by wading.

Daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1907 and 1908.

[Walter Swart, Observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1907.					1907.				
1	.....	0.75	0.8	1.05	16	0.7	0.7	0.8	1.35
2	.....	.75	.8	1.05	17	.7	.7	.8	1.3
3	.....	.75	.8	1.0	18	.7	.7	.8	1.25
4	.....	.7	.8	1.0	19	.7	.7	.8	1.25
5	.....	.7	.8	1.0	20	.7	.7	.8	1.25
6	.....	.7	.8	1.0	21	.7	.7	.85	1.25
7	.....	.7	.8	1.0	22	.7	.7	.85	2.2
8	.....	.7	.8	1.05	23	.7	.7	.9	2.35
9	.....	.7	.8	1.05	24	.7	.7	.95	3.7
10	.....	.7	.8	1.05	25	.7	.7	1.65	3.0
11	.....	.7	.8	1.05	26	.7	.7	1.55	3.0
12	.....	.7	.8	1.1	27	.7	.7	1.4	3.0
13	0.7	.7	.8	1.2	28	.7	.7	1.25	2.5
14	.7	.7	.8	1.5	29	.7	.7	1.15	2.3
15	.7	.7	.8	1.45	30	.7	.8	1.1	2.05
					31	.....	.8	.....	1.85

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	1.7	1.3	2.1	1.65	1.8	0.9	0.45	0.05	.....	0.1	0.4	0.4
2	1.65	1.3	2.0	1.7	1.8	.85	.45	.05	.....	.1	.4	.4
3	1.6	1.3	2.0	1.85	1.7	.85	.4	.05	.....	.1	.4	.4
4	1.55	1.35	1.9	2.0	1.65	.8	.4	.0	.....	.1	.35	.4
5	1.55	1.35	1.85	1.9	1.6	.8	.35	.0	.....	.1	.35	.4
6	1.55	1.35	1.85	1.8	1.6	.8	.35	.0	.....	.1	.35	.35
7	1.5	1.4	1.75	1.65	1.55	.75	.35	.0	.....	.1	.35	.35
8	1.5	1.4	1.6	1.6	1.5	.75	.3	.0	.....	.1	.35	.4
9	1.5	1.4	1.5	1.65	1.45	.75	.3	.0	0.0	.1	.35	.45
10	1.5	1.4	1.55	1.8	1.4	.7	.3	.0	.0	.1	.3	.45
11	1.5	1.45	1.7	2.5	1.4	.65	.3	.0	.0	.1	.3	.5
12	1.5	1.45	1.8	2.85	1.4	.65	.25	.0	.0	.15	.3	.6
13	1.45	1.5	2.3	2.9	1.4	.6	.25	.0	.0	.2	.3	.6
14	1.45	1.5	3.85	2.8	1.35	.6	.25	.0	.0	.4	.3	.6
15	1.45	1.55	7.6	2.8	1.35	.6	.25	.0	.0	.4	.3	.6
16	1.45	1.65	5.8	2.75	1.5	.6	.2	([a])	.0	.3	.3	.55
17	1.45	1.75	4.5	2.75	1.35	.55	.2	.....	.05	.25	.3	.5
18	1.4	1.7	3.0	2.75	1.35	.55	.2	.....	.1	.2	.3	.5
19	1.4	1.7	2.8	2.8	1.3	.6	.15	.....	.15	.25	.3	.45
20	1.4	1.65	2.3	2.8	1.25	.65	.15	.....	.15	.25	.4	.45
21	1.4	1.65	2.0	2.8	1.25	.6	.15	.....	.15	.25	.45	.45
22	1.35	1.65	2.0	2.6	1.25	.55	.15	.....	.15	.3	.5	.4
23	1.35	1.7	2.0	2.5	1.25	.55	.15	.....	.15	.3	.5	.4
24	1.35	1.75	2.05	2.35	1.25	.55	.15	.....	.1	.3	.5	.4
25	1.35	1.8	2.1	2.3	1.25	.5	.1	.....	.1	.3	.45	.4
26	1.35	1.9	2.0	2.1	1.2	.5	.1	.....	.05	.3	.45	.4
27	1.35	2.05	1.9	2.0	1.1	.5	.1	.....	.05	.4	.45	.4
28	1.35	2.15	1.75	1.9	1.1	.5	.1	.....	.05	.4	.45	.4
29	1.35	2.1	1.7	1.85	1.1	.45	.1	.....	.05	.4	.45	.4
30	1.3	.....	1.6	1.8	1.05	.45	.1	.....	.05	.45	.4	.4
31	1.3	.....	1.6	.....	1.0	.....	.1	.....	.....	.45	.....	.4

[a] From August 16 to September 8 gage heights are recorded as .0, but probably —.05 is more nearly correct.

Rating tables for Umatilla River at Gibbon, Oreg.

SEPTEMBER 13, 1907, TO MARCH 14, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	65	1.60	308	2.50	895	3.40	1,910
.80	80	1.70	350	2.60	995	3.50	2,025
.90	100	1.80	400	2.70	1,105	3.60	2,140
1.00	120	1.90	450	2.80	1,220	3.70	2,260
1.10	145	2.00	510	2.90	1,335	3.80	2,380
1.20	170	2.10	575	3.00	1,450	3.90	2,500
1.30	200	2.20	645	3.10	1,565		
1.40	234	2.30	720	3.20	1,680		
1.50	270	2.40	800	3.30	1,795		

MARCH 15, 1908, TO DECEMBER 31, 1908.[b]

−0.10	52	1.20	450	2.50	1,680	4.60	4,590
.00	65	1.30	510	2.60	1,795	4.80	4,930
.10	80	1.40	575	2.70	1,910	5.00	5,270
.20	100	1.50	645	2.80	2,025	5.20	5,610
.30	120	1.60	720	2.90	2,140	5.40	5,950
.40	145	1.70	800	3.00	2,260	5.60	6,290
.50	170	1.80	895	3.20	2,500	5.80	6,650
.60	200	1.90	995	3.40	2,760	6.00	7,010
.70	234	2.00	1,105	3.60	3,040	7.00	8,880
.80	270	2.10	1,220	3.80	3,340	8.00	10,780
.90	308	2.20	1,335	4.00	3,640		
1.00	350	2.30	1,450	4.20	3,940		
1.10	400	2.40	1,565	4.40	4,260		

[a] Not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1907 and the form of the 1908 curve and is not well defined.

[b] Not applicable for ice or obstructed-channel conditions. It is based on three discharge measurements made during 1908 and is fairly well defined below gage height 2.4 feet.

Monthly discharge of Umatilla River at Gibbon, Oreg., for 1907 and 1908.

[Drainage area, 353 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
September 13–30	65	65	65.0	0.184	0.12	2,320	B.
October	80	65	66.6	.189	.22	4,100	B.
November	329	80	111	.314	.35	6,600	B.
December	2,260	120	451	1.28	1.48	27,700	C.
1908.							
January	350	200	252	.714	.82	15,500	C.
February	610	200	318	.901	.97	18,300	C.
March	10,000	270	1,470	4.16	4.80	90,400	C.
April	2,140	720	1,400	3.97	4.43	83,300	C.
May	895	350	568	1.61	1.86	34,900	B.
June	308	158	215	.609	.68	12,800	B
July	158	80	107	.303	.35	6,580	B.
August	72	58	62.1	.176	.20	3,820	C.
September	90	58	70.2	.199	.22	4,180	C.
October	158	80	109	.309	.36	6,700	B.
November	170	120	139	.394	.44	8,270	B.
December	200	132	157	.445	.51	9,650	B.
The year	10,000	58	406	1.15	15.64	294,000	

UMATILLA RIVER AT YOAKUM, OREG.

This station, which was established May 5, 1903, is located 18 miles below Pendleton, 1½ miles east of the Yoakum station of the Oregon Railroad and Navigation Company. No tributaries enter in the

immediate vicinity of the station, but water is diverted for irrigation by a number of ditches both above and below, the most important being the Horseshoe ditch, which takes water about 1 mile above the gaging site. A number of large canals take water from the river at points farther down, the largest of these being a supply canal for Cold Springs reservoir, which has recently been constructed by the United States Reclamation Service for the Umatilla project.

The gage datum has not been changed since the station was established. Conditions are favorable for good results at all stages except extreme high water, when the banks of the stream in the vicinity of the station overflow and the entire flood plain is covered.

Discharge measurements of Umatilla River at Yoakum, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 7	I. E. Oakes	76	332	5.54	1,120
September 10	E. F. Kreigsman	81	139	3.01	57
1908.					
March 19	J. C. Stevens	77	482	7.20	3,250
June 5	H. D. McGlashan	76	204	3.90	278
October 13	L. R. Allen	76	132	3.02	55

Daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1907.

[Luther Dehanen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	5.9	6.7	6.6	5.8	5.0	4.0	3.3	2.8	3.0	3.2	3.4	3.7
2	5.4	6.0	6.5	6.1	5.0	3.9	3.3	2.8	3.0	3.2	3.4	3.7
3	5.55	5.8	6.3	6.1	5.4	3.8	3.3	2.8	3.0	3.2	3.3	3.8
4	6.15	6.0	6.0	6.1	5.4	3.8	3.3	2.8	3.0	3.3	3.3	3.6
5	6.0	7.6	5.9	6.1	5.4	3.8	3.3	2.7	3.1	3.3	3.2	3.6
6	5.5	9.5	5.9	6.0	5.4	3.7	3.3	2.7	3.2	3.3	3.2	3.6
7	5.5	7.95	5.8	7.2	5.4	3.7	3.3	2.7	3.3	3.3	3.2	3.6
8	5.4	7.8	5.7	7.8	5.4	3.6	3.3	2.7	3.3	3.3	3.3	3.8
9	5.2	7.6	5.7	8.15	5.3	3.6	3.3	2.7	3.2	3.3	3.3	3.7
10	5.0	7.4	5.7	8.3	5.2	3.6	3.2	2.7	3.2	3.3	3.3	3.6
11	5.0	6.9	5.7	7.7	5.1	3.7	3.1	2.9	3.1	3.3	3.2	3.6
12	4.8	6.7	5.6	7.4	5.0	3.8	3.1	2.9	3.1	3.4	3.3	3.6
13	4.8	6.3	5.6	7.3	4.9	3.8	3.0	2.9	3.2	3.4	3.2	3.7
14	4.6	6.4	5.5	7.2	4.9	3.8	3.0	3.0	3.3	3.4	3.2	3.7
15	4.5	6.3	5.4	7.0	4.9	3.7	3.0	3.0	3.3	3.3	3.2	3.8
16	4.4	6.3	5.4	6.9	4.9	3.7	3.0	3.0	3.3	3.3	3.3	3.9
17	4.4	6.2	5.3	6.6	4.9	3.6	3.0	3.0	3.3	3.4	3.3	3.8
18	4.3	6.1	5.6	6.4	4.9	3.6	3.0	2.9	3.3	3.4	3.2	3.8
19	4.3	6.9	6.3	6.4	4.9	3.5	3.0	2.9	3.3	3.4	3.2	3.8
20	4.4	6.8	6.95	6.3	4.9	3.4	3.0	2.9	3.3	3.4	3.4	3.8
21	4.3	6.9	7.8	6.3	4.7	3.4	2.9	2.9	3.3	3.3	3.4	3.8
22	4.3	6.7	7.55	6.3	4.6	3.4	2.9	2.9	3.3	3.3	3.4	3.95
23	4.3	6.9	7.1	6.4	4.5	3.4	2.9	2.9	3.2	3.3	3.5	5.35
24	4.4	6.9	6.7	6.5	4.4	3.3	2.9	2.9	3.2	3.3	3.5	6.8
25	4.4	7.2	6.5	6.2	4.3	3.3	2.9	2.9	3.2	3.4	3.6	6.5
26	4.4	7.3	6.3	6.0	4.3	3.3	2.9	2.9	3.2	3.4	4.1	7.4
27	4.4	7.1	6.1	5.8	4.2	3.3	2.9	3.1	3.2	3.3	4.1	6.5
28	4.3	6.9	5.8	5.6	4.1	3.3	2.9	3.1	3.2	3.3	4.0	5.8
29	4.0	.....	5.7	5.5	4.1	3.3	2.9	3.0	3.2	3.4	3.8	5.3
30	4.0	.....	5.5	5.4	4.0	3.3	2.8	3.0	3.2	3.4	3.7	4.9
31	6.3	.....	5.5	.....	4.0	.....	2.8	3.0	.....	3.4	.....	4.8

[a] River was frozen along the banks January 10 to 14, the ice reaching a maximum thickness of about 3 inches.

Daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1908.

[John Doherty, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.50	4.10	5.60	5.40	5.15	4.00	3.08	2.60	2.68	2.90	3.48	3.40
2	4.50	4.00	5.30	5.42	5.45	4.00	3.00	2.58	2.62	2.85	3.50	3.40
3	4.50	4.00	5.10	5.62	5.35	3.98	2.98	2.55	2.62	2.90	3.48	3.40
4	4.40	4.00	5.00	5.90	4.95	3.95	2.92	2.52	2.60	2.92	3.45	3.40
5	4.40	3.80	4.10	5.90	4.82	3.88	2.92	2.50	2.60	2.90	3.40	3.35
6	4.30	3.80	4.80	5.80	4.78	3.85	2.90	2.50	2.60	2.90	3.35	3.35
7	4.30	3.80	4.80	5.65	4.78	3.82	2.90	2.50	2.60	2.90	3.35	3.35
8	4.30	3.90	4.60	5.50	4.72	3.75	2.88	2.50	2.60	2.90	3.35	3.35
9	4.30	3.90	4.60	5.62	4.60	3.70	2.80	2.50	2.55	2.90	3.35	3.35
10	4.30	4.00	4.50	5.98	4.48	3.70	2.80	2.45	2.60	2.90	3.30	3.35
11	4.20	4.10	4.60	6.35	4.40	3.70	2.80	2.45	2.60	2.88	3.28	3.35
12	4.20	4.20	4.80	6.78	4.35	3.62	2.75	2.45	2.60	2.90	3.25	3.40
13	4.30	4.20	5.30	6.98	4.28	3.60	2.72	2.55	2.60	3.00	3.25	3.40
14	4.30	4.20	6.50	7.00	4.20	3.60	2.72	2.60	2.55	3.10	3.22	3.50
15	4.20	4.20	10.00	6.80	4.20	3.52	2.80	2.78	2.58	3.10	3.25	3.50
16	4.20	4.30	.....	6.70	4.28	3.42	2.82	2.70	2.68	3.20	3.25	3.52
17	4.10	4.50	9.00	6.58	4.32	3.40	2.85	2.75	2.75	3.20	3.20	3.50
18	4.10	4.90	7.80	6.48	4.38	3.40	2.85	2.65	2.85	3.20	3.25	3.50
19	4.10	5.00	7.14	6.55	4.42	3.40	2.85	2.60	2.90	3.20	3.25	3.50
20	4.10	5.00	6.68	6.90	4.40	3.40	2.80	2.60	2.90	3.20	3.30	3.50
21	4.20	4.80	6.28	6.68	4.38	3.45	2.80	2.58	2.82	3.55	3.30	3.50
22	4.20	4.70	5.95	6.45	4.38	3.45	2.75	2.55	2.78	3.50	3.32	3.50
23	4.30	4.60	5.80	6.18	4.40	3.40	2.80	2.55	2.75	3.45	3.35	3.50
24	4.20	4.60	5.90	5.90	4.32	3.38	2.75	2.52	2.75	3.40	3.40	3.48
25	4.20	4.80	6.05	5.75	4.30	3.30	2.70	2.55	2.85	3.40	3.42	3.40
26	4.10	5.00	6.02	5.55	4.30	3.30	2.70	2.55	2.80	3.38	3.45	3.40
27	4.00	5.50	5.85	5.42	4.22	3.22	2.70	2.58	2.88	3.35	3.45	3.40
28	4.00	5.80	5.60	5.32	4.18	3.20	2.70	2.65	2.88	3.35	3.45	3.35
29	4.00	5.70	5.40	5.18	4.15	3.20	2.70	2.65	2.88	3.35	3.42	3.40
30	4.00	.....	5.35	5.12	4.12	3.15	2.68	2.65	2.82	3.35	3.45	3.40
31	4.00	.....	5.40	.....	4.08	.....	2.65	2.65	.....	3.38	.....	3.40

Rating table for Umatilla River at Yoakum, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	9	3.80	242	5.20	1,030	7.20	3,200
2.50	14	3.90	277	5.30	1,100	7.40	3,490
2.60	20	4.00	318	5.40	1,180	7.60	3,790
2.70	28	4.10	363	5.50	1,270	7.80	4,090
2.80	38	4.20	410	5.60	1,360	8.00	4,400
2.90	49	4.30	465	5.70	1,450	8.20	4,730
3.00	62	4.40	520	5.80	1,550	8.40	5,070
3.10	75	4.50	580	5.90	1,650	8.60	5,430
3.20	90	4.60	640	6.00	1,750	8.80	5,790
3.30	110	4.70	700	6.20	1,960	9.00	6,150
3.40	130	4.80	760	6.40	2,180	10.00	8,200
3.50	153	4.90	820	6.60	2,420		
3.60	179	5.00	890	6.80	2,660		
3.70	208	5.10	960	7.00	2,920		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 31 discharge measurements made during 1903–1908, and is well defined below gage height 9.0 feet.

Monthly discharge of Umatilla River at Yoakum, Oreg., for 1907 and 1908.

[Drainage area, 1,200 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	2,070	318	845	0.704	0.81	52,000	A.
February	7,230	1,550	2,880	2.40	2.50	160,000	A.
March	4,090	1,100	1,870	1.56	1.80	115,000	A.
April	4,900	1,180	2,460	2.05	2.29	146,000	A.
May	1,180	318	792	.660	.76	48,700	A.
June	318	110	173	.144	.16	10,300	A.
July	110	38	72.4	.060	.07	4,450	B.
August	75	28	48.1	.040	.05	2,960	B.
September	110	62	92.1	.077	.09	5,480	B.
October	130	90	116	.097	.11	7,130	B.
November	363	90	144	.120	.13	8,570	B.
December	3,480	179	675	.562	.65	41,500	A.
The year	7,230	28	847	.706	9.42	602,000	
1908.							
January	580	318	425	.354	.41	26,100	A.
February	1,550	242	594	.495	.53	34,200	A.
March [a]	16,000	363	2,260	1.88	2.17	139,000	B.
April	2,920	974	1,850	1.54	1.72	110,000	A.
May	1,220	354	582	.485	.56	35,800	A.
June	318	82	178	.148	.17	10,600	A.
July	72	24	39.6	.033	.04	2,430	B.
August	36	12	19.1	.016	.02	1,170	B.
September	49	17	30.3	.025	.03	1,800	B.
October	166	44	87.1	.073	.08	5,360	B.
November	153	90	121	.101	.11	7,200	B.
December	158	120	136	.113	.13	8,360	B.
The year	16,000	12	526	.439	5.97	382,000	

[a] Discharge of March 14 estimated at 16,000 second feet.

UMATILLA RIVER NEAR UMATILLA, OREG.

This station, which was established October 21, 1903, in order to determine the quantity of water flowing into Columbia River after the irrigation requirements had been satisfied, is located 1½ miles above the mouth of the river near the town of Umatilla, one-fourth mile below the diversion point of the Oregon Land and Water Company's canal, and one-fourth mile above the headgate of the Brownell ditch.

The conditions at the station are favorable for excellent results. The bed and banks of the stream for the half mile above and below the station are of solid rock, and an absolutely permanent rating curve has been obtained. The velocity of the water at this point is sufficiently rapid to prevent the deposit of silt or sand in the vicinity of the station, and even at extreme floods the water is all confined within the banks of the stream.

Discharge measurements of Umatilla River near Umatilla, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	J. C. Stevens	193	1,070	8.03	10,500
Do	do	192	1,000	7.66	9,230
Do	do	191	919	7.28	7,920
March 18	do	184	710	6.15	5,220
June 6	H. D. McGlashan	79	44	2.25	45
October 12	L. R. Allen	8	12	1.57	2.7

Daily gage height, in feet, of Umatilla River near Umatilla, Oreg., for 1907 and 1908.

[W. A. Walpole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	4.1	5.2	4.6	4.0	3.7	2.7	1.9	1.4	1.5	2.1	2.2	2.7
2	4.1									2.1	2.25	2.7
3	4.0	5.0	4.4	4.3	3.7	2.6	1.7	1.4	1.5	2.1	2.25	2.65
4			4.3							2.1	2.25	2.65
5	4.0	5.0	4.3	4.3	3.6	2.55	1.6	1.4	2.1	2.1	2.3	2.6
6										2.0	2.3	2.6
7	3.9	6.3	4.2	4.4	3.6	2.5	1.5	1.4	2.4	2.0	2.3	2.6
8				5.4						2.0	2.3	2.6
9	3.8	5.8	4.2	5.4	3.6	2.4	1.5	1.5	2.1	2.0	2.3	2.55
10				5.8						1.9	2.3	2.55
11	3.6	5.5	4.1	5.9	3.6	2.35	1.5	1.4	1.9	1.9	2.3	2.65
12				5.4						1.9	2.3	2.7
13	3.5	5.2	4.0	5.1	3.4	2.3	1.5	1.4	1.8	1.9	2.3	2.7
14		5.0				2.6				1.9	2.3	2.7
15	3.4	4.8	3.9	5.0	3.4	2.5	1.5	1.4	2.25	1.9	2.3	2.75
16		4.6								1.9	2.3	2.8
17	3.3	4.5	4.0	4.7	3.35	2.4	1.4	1.4	2.2	1.9	2.3	2.8
18										1.9	2.35	2.8
19	3.2	4.4	4.1	4.4	3.3	2.4	1.4	1.4	2.2	1.9	2.35	2.75
20		4.8			3.4					1.9	2.25	2.75
21	3.2	4.8	5.5	4.3	3.3	2.35	1.4	1.4	2.25	1.95	2.25	2.75
22										1.95	2.3	
23	3.1	4.7	5.5	4.3	3.2	2.3	1.4	1.4	2.25	1.95	2.3	
24										1.95	2.3	
25	3.0	4.8	4.7	4.2	3.0	2.35	1.5	1.4	2.15	2.1	2.4	
26						2.45				2.1	2.45	4.23
27	3.0	5.0	4.5	4.1	3.0	2.35	1.4	1.4	2.1	2.1	2.8	4.68
28		4.8				2.1				2.1	2.85	
29	3.0		4.2	3.8	2.9	1.9	1.4	1.4	2.1	2.1	2.8	
30				3.75		1.9		1.5	2.1	2.15	2.75	
31	3.0		4.1		2.8		1.4	1.5		2.15		
1908.[b]												
1			3.5	3.5	3.4	2.5	1.65	1.4	1.4	2.1	2.3	2.3
2			3.5	3.5	3.4	2.5	1.65	1.4	1.4	1.8	2.25	
3			3.5	3.5	3.4	2.4	1.6	1.4	1.4	1.8	2.25	2.3
4			3.4	3.8	3.3	2.4	1.6	1.4	1.5	1.85	2.25	
5			3.3	4.0	3.2	2.35	1.6	1.4	1.5	1.85	2.25	2.3
6			3.2	3.9	3.2	2.3	1.5	1.4	1.5	1.85	2.3	
7			3.2	3.8	3.15	2.4	1.5	1.4	1.5	1.85	2.35	2.3
8		2.9	3.1	3.7	3.1	2.5	1.5	1.4	1.4	1.7	2.35	
9			3.0	3.7	3.1	2.5	1.5	1.4	1.4	1.7	2.4	2.3
10	3.0		3.0	3.8	3.0	2.6	1.5	1.4	1.4	1.65		
11			3.0	4.1	3.0	2.5	1.5	1.4	1.4	1.65		2.3
12			3.0	4.25	2.9	2.5	1.5	1.4	1.4	1.65	2.35	
13			3.2	4.58	2.8	2.5	1.5	1.4	1.4	1.65		
14			3.7	4.55	2.75	2.45	1.92	1.4	1.4	1.7	2.3	
15		2.95	4.9	4.5	2.7	2.5	2.0	1.4	1.4	1.75		2.5
16			8.0	4.45	2.7	2.2	1.6	1.4	1.4	1.8	2.3	
17		3.0	7.86	4.4	2.75	2.1	1.5	1.4	1.4	1.85		2.5
18		3.2	6.16	4.3	2.8	2.05	1.5	1.4	1.4	2.0	2.3	
19		3.5	5.26	4.2	2.85	2.0	1.6	1.4	1.4	2.15		2.5
20		3.5	4.65	4.3	2.8	2.0	1.5	1.4	1.4	2.25		
21		3.35	4.38	4.4	2.8	2.1	1.5	1.4	1.4	2.25	2.3	2.5
22		3.3	4.33	4.3	2.85	2.1	1.5	1.4	1.4	2.3		
23		3.25	4.0	4.18	2.95	2.0	1.5	1.4	1.4	2.35	2.3	2.45
24		3.2	4.0	4.05	2.95	2.0	1.4	1.4	1.5	2.35	2.25	
25		3.2	4.0	3.9	3.0	2.0	1.4	1.4	1.8	2.4		
26		3.3	4.0	3.8	2.9	1.9	1.4	1.4	2.0	2.4		2.4
27	2.9	3.35	4.0	3.6	2.8	1.9	1.4	1.4	2.0	2.4	2.3	
28		3.4	3.8	3.5	2.75	2.1	1.4	1.4	2.0	2.4	2.3	2.4
29		3.4	3.7	3.45	2.7	2.0	1.4	1.4	2.1	2.4		
30			3.65	3.4	2.65	1.7	1.4	1.4	2.1	2.35	2.3	2.35
31			3.6		2.6		1.4	1.4		2.35		

[a] The river was not frozen at the gage during the winter of 1906–7, but was frozen along the edge extending out about 40 feet from January 15 to February 1; there was some slush ice running during this time.
[b] No ice during the year.

Rating table for Umatilla River near Umatilla, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	0.4	2.80	210	4.10	1,520	5.80	4,460
1.50	.5	2.90	270	4.20	1,665	6.00	4,910
1.60	.7	3.00	340	4.30	1,815	6.20	5,370
1.70	1.5	3.10	415	4.40	1,970	6.40	5,830
1.80	3.5	3.20	495	4.50	2,130	6.60	6,300
1.90	8.0	3.30	580	4.60	2,290	6.80	6,790
2.00	14	3.40	670	4.70	2,450	7.00	7,300
2.10	22	3.50	770	4.80	2,620	7.20	7,850
2.20	34	3.60	880	4.90	2,790	7.40	8,430
2.30	49	3.70	995	5.00	2,960	7.60	9,010
2.40	68	3.80	1,115	5.20	3,310	7.80	9,590
2.50	90	3.90	1,245	5.40	3,675	8.00	10,170
2.60	120	4.00	1,380	5.60	4,050	9.00	13,100
2.70	160						

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based upon 31 discharge measurements made during 1903–1908 and is well defined.

Monthly discharge of Umatilla River near Umatilla, Oreg., for 1907 and 1908.

[Drainage area, 2,130 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,520	340	766	0.360	0.42	47,100	A.
February	5,600	1,970	3,120	1.46	1.52	173,000	A.
March	3,860	1,240	2,000	.939	1.08	123,000	A.
April	4,680	1,060	2,280	1.07	1.19	136,000	A.
May	995	210	647	.304	.35	39,800	A.
June	160	8	73.3	.034	.04	4,360	A.
July	8	.4	.89	.00042	.0005	54.7	C.
August	.5	.4	.41	.00019	.0002	25.2	C.
September	68	.5	26.4	.012	.01	1,570	B.
October	28	8	15.0	.0070	.008	922	B.
November	240	34	71.2	.033	.04	4,240	A.
December [a]	.....	105	517	.243	.28	31,800	C.
The year	5,600	.4	793	.372	4.94	562,000	
1908.							
January [a]	.....	.....	337	.158	.18	20,700	C.
February [a]	.....	.....	417	.196	.21	24,000	B.
March	10,200	340	1,820	.854	.98	112,000	A.
April	2,260	670	1,390	.653	.73	82,700	A.
May	670	120	318	.149	.17	19,600	A.
June	120	1.5	49.0	.023	.03	2,920	A.
July	14	.4	1.26	.00059	.0007	77.5	C.
August	.4	.4	.40	.00019	.0002	24.6	C.
September	22	.4	3.32	.0016	.002	198	C.
October	68	1.1	26.4	.012	.01	1,620	B.
November	68	42	50.2	.024	.03	2,990	A.
December	90	49	66.4	.31	.04	4,080	A.
The year	10,200	.4	373	.175	2.38	271,000	

[a] Discharges interpolated December 22, 1907 to February 16, 1908, with the aid of a hydrograph following the rise and fall of the river at Yoakum.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the Umatilla River drainage basin in Oregon, during 1907 and 1908:

Miscellaneous measurements in Umatilla River basin, in 1907 and 1908.

Date.	Stream.	Locality.	Discharge.
			Sec.-ft.
August 24, 1907	Umatilla River	Gibbon	55
August 23, 1907	do	1 mile below Pendleton	26
August 27, 1907	do	1 mile below Echo, just above Dillon.	16
August 28, 1907	do	One-half mile above Umatilla	0.6
August 24, 1907	Meacham Creek	500 feet above mouth	10
August 23, 1908	McKay Creek	Powell's ranch	1
August 30, 1907	do	One-eighth mile above mouth	.9
August 25, 1907	Ditch	2½ miles above Pendleton	2.0
June 27, 1907	Oliver's ditch	Below Pendleton	2.1
August 23, 1907	do	do	6.6
August 23, 1907	Deleture's ditch	2 miles below Pendleton	.34
August 23, 1907	Crowner's ditch	3 miles below Pendleton	1.8
May 9, 1907	J. E. Smith's ditch	Barnhart	5.6
June 24, 1907	do	do	8.5
August 31, 1907	do	do	.7
August 27, 1907	Wilson's ditch	Above Echo	3.1
May 4, 1907	Furnish ditch	do	13
June 24, 1907	do	do	12
May 8, 1907	Allen ditch	Echo	26
June 25, 1907	do	do	9.6
August 27, 1907	do	do	12
May 3, 1907	Hinkle ditch	do	29
June 25, 1907	do	do	10
August 27, 1907	do	do	14
May 6, 1907	Pioneer ditch	do	18
June 25, 1907	do	do	39
August 29, 1907	Dillon ditch	Below Echo	.8
May 5, 1907	Maxwell ditch	9 miles below Echo	22
August 29, 1907	do	do	12
May 7, 1907	Oregon Land and Water Company's ditch.	1 mile above Umatilla	40
June 26, 1907	do	do	43
August 28, 1907	do	do	24
June 6, 1908	do	do	[a] 45
April 25, 1907	Brownell ditch	Railroad crossing near Umatilla	9.6
May 7, 1907	do	1 mile above Umatilla	8.6
June 26, 1907	do	do	3.5
June 28, 1907	do	do	1.4
May 7, 1907	Hamilton & Brown ditch	One-half mile above Umatilla	1.2

[a] Gage height, 1.15 feet; measured at bridge near intake.

JOHN DAY RIVER DRAINAGE BASIN.

DESCRIPTION.

John Day River, which drains the country to the northwest of the Blue Mountains, rises on the divide between Grant and Baker counties, Oreg., flows westward and then northward and joins the Columbia about 28 miles above The Dalles. Its principal tributaries are are the North, Middle, and South forks. Its total drainage area includes 7,800 square miles. The general elevation of its headwaters is about 6,000 feet above sea level; at Fossil the elevation is about 1,500 feet.

Only the headwater region of the stream is forested, the greater part of the basin being utilized as range for sheep and cattle or for the growing of wheat by the "dry farming" process.

The mean annual rainfall varies from 24 inches on the headwaters to 10 inches at the mouth. The winters are cold, and the streams are frequently icebound throughout the greater part of the winter. Except wheat, which is raised on the rolling uplands, no agricultural products of consequence can be raised without irrigation, and as the areas which admit of easy irrigation are confined to the immediate valleys of the streams, comparatively little has been done in this direction. A number of projects are, however, contemplated, under which, by means of storage reservoirs and high-line canals enormous areas of very productive table-lands would be developed. The storage facilities are ample for this purpose. It is not likely that extensive development will be undertaken until more detailed studies of flow have been made. Since records have been kept, the highest run-off occurred in 1907 and the lowest in 1905.

The following gaging stations have been maintained in this river basin:

John Day River near Dayville (1908).
John Day River at McDonald (1904 to 1908).
South Fork of John Day River at Dayville (1908).
Rock Creek near Arlington, Oreg. (1905).

JOHN DAY RIVER NEAR DAYVILLE, OREG.

This station, which was established November 23, 1908, is located at McRae's ranch, 3 miles above Dayville, and 3 miles above the mouth of the South Fork of the John Day River.

The data obtained here will be valuable chiefly for the study of the possibilities of irrigation from this stream by means of storage, as a number of excellent reservoir sites are found on the river above this point.

The following measurement was made November 23, 1908:

Width, 40 feet; area, 62 square feet; gage height, 0.55 feet; discharge, 154 second-feet.

Daily gage height, in feet, of John Day River near Dayville, Oreg., for 1908.

[Kenneth F. McRae, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.40	9		0.42	17		0.40	25	0.50	0.42
2		.42	10		.42	18		(a)	26	.42	.42
3		.42	11		.42	19		(a)	27	.40	.42
4		.50	12		.50	20		(a)	28	.40	.42
5		.50	13		.50	21		(a)	29	.40	.42
6		.42	14		.50	22		.50	30	.40	.42
7		.42	15		.42	23		.50	31		.40
8		.42	16		.42	24	0.50	.50			

a No gage reading.

JOHN DAY RIVER AT McDONALD, OREG.

This station, which was established December 16, 1904, is located at McDonald Ferry and post-office, 16 miles above the mouth of the stream, and one-half mile below the mouth of Rock Creek.

The results obtained at this station are of considerable economic importance, as the stream will be used for both water power and irrigation. Storage reservoirs must, however, be constructed to equalize the flow of the stream, which in its natural condition is subject to wide fluctuations. The winter gage heights are sometimes disturbed for short periods by ice conditions, but it is thought improbable that the reliability of the results has been affected to any important degree. The general conditions at the station are exceptionally favorable, and what appears to be an absolutely permanent rating curve has been established. The datum of the gage has not been changed and the data are considered absolutely trustworthy.

The following measurement was made November 24, 1908:

Width, 263 feet; area, 542 square feet; gage height, 1.87 feet; discharge, 427 second-feet.

Daily gage height, in feet, of John Day River at McDonald, Oreg., for 1907 and 1908.

[William Murray, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	3.10	5.65	5.25	4.60	5.20	4.15	3.00	1.85	1.50	1.55	1.75	2.00
2	3.00	5.70	5.05	4.60	5.10	4.25	2.90	1.90	1.50	1.55	1.75	2.00
3	2.75	4.55	4.95	4.85	5.00	4.35	2.82	1.83	1.50	1.65	1.82	2.00
4	2.90	4.10	4.60	5.00	5.05	4.25	2.75	1.80	1.58	1.72	1.85	1.95
5	3.32	7.08	4.50	5.00	5.10	4.05	2.65	1.80	1.62	1.70	1.85	1.95
6	4.60	10.38	4.25	5.30	5.10	4.00	2.70	1.75	1.60	1.75	1.85	1.90
7	3.75	8.30	4.30	5.10	5.10	4.00	2.68	1.70	1.70	1.72	1.85	1.90
8	3.25	7.18	4.35	5.85	5.10	4.00	2.60	1.70	1.60	1.70	1.85	1.90
9	2.95	6.50	4.50	6.48	5.10	3.85	2.48	1.70	1.60	1.70	1.85	1.90
10	2.60	6.15	4.50	6.70	5.10	3.70	2.40	1.70	1.60	1.70	1.80	1.90
11	2.60	6.05	4.55	6.90	5.15	3.60	2.35	1.70	1.60	1.70	1.80	1.98
12	2.70	5.65	4.60	6.85	5.35	3.50	2.30	1.70	1.55	1.70	1.80	2.00
13	2.50	5.45	4.50	6.80	5.25	3.85	2.28	1.70	1.50	1.70	1.80	2.00
14	2.30	5.30	4.40	7.15	5.15	3.95	2.20	1.70	1.50	1.70	1.80	2.00
15	2.12	5.20	4.30	7.50	4.85	3.85	2.18	1.70	1.50	1.70	1.80	2.00
16	2.10	5.15	4.20	7.50	4.70	3.75	2.15	1.70	1.50	1.70	1.80	2.00
17	1.95	5.15	4.10	7.25	4.75	3.65	2.10	1.70	1.50	1.70	1.80	2.00
18	1.85	5.15	4.10	7.85	5.05	3.50	2.22	1.65	1.50	1.70	1.80	2.00
19	2.00	5.10	5.55	6.55	5.25	3.45	2.15	1.60	1.50	1.70	1.90	1.90
20	2.35	5.00	8.50	6.50	5.25	3.35	2.10	1.60	1.50	1.70	1.90	1.90
21	2.70	5.55	8.80	6.25	5.50	3.20	2.05	1.55	1.50	1.70	1.90	1.80
22	2.90	5.50	8.20	6.00	5.25	3.25	2.02	1.55	1.55	1.70	1.85	1.80
23	2.70	5.50	7.15	5.95	4.95	3.35	2.00	1.55	1.55	1.70	1.85	1.90
24	2.60	5.50	6.50	6.05	4.75	3.40	2.00	1.50	1.55	1.70	1.85	2.00
25	2.65	5.40	6.05	6.10	4.55	3.35	2.00	1.95	1.55	1.70	1.90	2.30
26	2.70	5.75	5.85	5.95	4.45	3.28	1.92	2.30	1.55	1.70	1.90	3.10
27	2.55	5.85	5.50	5.80	4.30	3.15	1.92	1.58	1.55	1.75	2.00	3.40
28	2.40	5.55	5.20	5.70	4.25	3.10	1.90	1.50	1.55	1.75	2.00	3.90
29	2.55	.....	5.00	5.55	4.20	3.00	1.85	1.50	1.55	1.75	2.08	3.25
30	2.50	.....	4.80	5.35	4.15	3.00	1.85	1.50	1.55	1.75	2.10	2.95
31	5.20	.....	4.70	.....	4.10	.....	1.85	1.50	.....	1.75	.....	2.75

[a] The river was partly frozen January 1 to 31; the ice reached a maximum thickness of 6 inches; slush ice was running all the time.

Daily gage height, in feet, of John Day River at McDonald, Oreg., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	2.60	2.20	2.70	3.50	4.10	3.48	2.62	1.55	1.35	1.60	1.85	1.70
2	2.50	2.05	2.65	3.45	4.20	3.38	2.60	1.55	1.35	1.60	1.85	1.70
3	2.50	1.95	2.52	3.35	4.30	3.30	2.58	1.55	1.35	1.60	1.90	1.62
4	2.50	1.95	2.52	3.20	4.40	3.20	2.50	1.50	1.35	1.60	2.05	1.72
5	2.50	2.10	2.50	3.30	4.20	3.20	2.50	1.50	1.40	1.60	2.00	1.80
6	2.40	2.20	2.42	3.50	4.00	3.25	2.45	1.45	1.40	1.60	2.00	1.90
7	2.40	2.30	2.40	3.60	3.90	3.18	2.40	1.40	1.40	1.60	1.90	1.90
8	2.35	2.30	2.40	3.55	3.90	3.10	2.30	1.40	1.40	1.60	1.90	1.90
9	2.30	2.30	2.38	3.45	4.10	3.20	2.28	1.40	1.35	1.60	1.90	1.90
10	2.25	2.30	2.35	3.45	4.00	3.30	2.20	1.40	1.35	1.60	1.85	1.85
11	2.30	2.22	2.30	3.65	3.85	3.55	2.18	1.35	1.35	1.65	1.85	1.85
12	2.30	2.20	2.32	4.00	3.70	3.60	2.10	1.35	1.30	1.65	1.85	1.85
13	2.42	2.20	2.50	4.35	3.62	3.70	2.02	1.35	1.30	1.65	1.85	1.85
14	2.38	2.20	2.68	4.85	3.50	3.70	2.65	1.40	1.30	1.65	1.85	1.80
15	2.40	2.20	3.10	5.05	3.50	3.65	2.30	1.40	1.35	1.68	1.80	1.80
16	2.40	2.10	4.90	5.15	3.35	3.60	2.02	1.35	1.40	1.70	1.80	1.80
17	2.50	2.10	7.15	5.40	3.45	3.60	2.00	1.35	1.40	1.70	1.80	1.80
18	2.45	2.10	6.70	5.55	3.45	3.52	2.10	1.35	1.35	1.90	1.80	1.80
19	2.40	2.18	5.65	5.30	3.35	3.45	2.05	1.35	1.35	2.10	1.80	2.00
20	2.40	2.20	5.00	5.30	3.30	3.38	2.00	1.40	1.40	2.00	1.80	1.90
21	2.35	2.20	4.50	5.65	3.35	3.20	1.90	1.65	1.45	1.90	1.80	1.90
22	2.55	2.18	4.25	5.75	3.65	3.10	1.90	1.45	1.55	1.90	1.85	1.70
23	2.70	2.15	4.00	5.60	3.70	3.10	1.90	1.55	1.70	1.90	1.85	1.75
24	2.50	2.10	3.95	5.50	3.70	3.10	1.80	1.50	1.70	1.90	1.85	1.75
25	2.35	2.10	3.90	5.25	3.60	3.98	1.80	1.48	1.60	1.90	1.85	1.80
26	2.25	2.15	3.90	4.95	3.60	2.82	1.80	1.50	1.60	1.85	1.90	1.80
27	2.32	2.20	4.10	4.70	3.70	2.80	1.75	1.45	1.55	1.80	1.95	1.80
28	2.30	2.30	3.95	4.48	3.70	2.80	1.70	1.40	1.55	1.80	1.90	1.80
29	2.30	2.50	3.75	4.35	3.55	2.80	1.70	1.40	1.55	1.82	1.90	1.82
30	2.20	.....	3.65	4.22	3.50	2.70	1.65	1.40	1.55	1.85	1.85	1.85
31	2.15	.....	3.45	.....	3.50	.....	1.60	1.35	.....	1.85	.....	1.90

[a] No ice reported in 1908

Rating table for John Day River at McDonald, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	125	2.50	1,015	3.70	2,690	5.80	7,590
1.40	165	2.60	1,125	3.80	2,870	6.00	8,150
1.50	210	2.70	1,240	3.90	3,050	6.20	8,710
1.60	260	2.80	1,360	4.00	3,240	6.40	9,290
1.70	320	2.90	1,485	4.20	3,650	6.60	9,880
1.80	385	3.00	1,615	4.40	4,090	6.80	10,480
1.90	460	3.10	1,750	4.60	4,550	7.00	11,100
2.00	540	3.20	1,890	4.80	5,020	8.00	14,310
2.10	625	3.30	2,035	5.00	5,500	9.00	17,760
2.20	715	3.40	2,185	5.20	6,000	10.00	21,360
2.30	810	3.50	2,345	5.40	6,520	11.00	25,100
2.40	910	3.60	2,515	5.60	7,050		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 23 discharge measurements made during 1904 to 1908, and is well defined between gage heights 1.2 feet and 6.7 feet.

Monthly discharge of John Day River at McDonald, Oreg., for 1907 and 1908.

[Drainage area, 7,800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January[a]	6,000	422	1,470	0.188	0.22	90,400	C.
February	22,800	3,440	7,890	1.01	1.05	438,000	A.
March	17,100	3,440	6,400	.821	.95	394,000	A.
April	13,800	4,550	8,550	1.10	1.23	509,000	A.
May	6,780	3,440	5,300	.679	.78	326,000	A.
June	3,980	1,620	2,630	.337	.38	156,000	A.
July	1,620	422	809	.104	.12	49,700	A.
August	810	210	324	.042	.05	19,900	A.
September	320	210	234	.030	.03	13,900	A.
October	352	235	321	.041	.05	19,700	A.
November	625	352	433	.056	.06	25,800	A.
December	3,050	385	791	.101	.12	48,600	A.
The year	22,800	210	2,930	.376	5.04	2,090,000	
1908.							
January	1,240	670	908	.116	.13	55,800	A.
February	1,020	500	700	.090	.10	40,300	A.
March	11,600	810	2,910	.373	.43	179,000	A.
April	7,460	1,890	4,390	.563	.63	261,000	A.
May	4,090	2,040	2,770	.355	.41	170,000	A.
June	17,100	1,240	2,520	.323	.36	150,000	A.
July	1,180	260	659	.084	.10	40,500	A.
August	290	145	182	.023	.03	11,200	A.
September	320	125	183	.024	.03	10,900	A.
October	625	260	357	.046	.05	22,000	A.
November	582	385	438	.056	.06	26,100	A.
December	540	272	400	.051	.06	24,600	A.
The year	17,100	125	1,370	.175	2.39	991,000	

[a] No correction made for ice conditions.

SOUTH FORK OF JOHN DAY RIVER AT DAYVILLE, OREG.

This station, which was established November 21, 1908, is located one-half mile above Dayville and 1 mile above the mouth of the stream. The Dayville ditch diverts water about one-fourth mile above the station, and the flow in the ditch should be included in that of the main river to determine the natural flow at this point.

The data obtained will be of value in determining the amount of water available for irrigation, as facilities for storing a large portion of the annual flow are afforded above this point.

The following measurement was made November 22, 1908:

Width, 71 feet; area, 51 square feet; gage height, 0.46 foot; discharge, 41 second-feet.

Daily gage height, in feet, of South Fork of John Day River at Dayville, Oreg., for 1908.

[J. Campbell Martin, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.41	9		0.42	17		0.40	25	0.48	0.41
2		.42	10		.42	18		.39	26	.48	.41
3		.42	11		.39	19		.43	27	.40	.41
4		.42	12		.43	20		.43	28	.39	.45
5		.45	13		.42	21		.43	29	.39	.45
6		.42	14		.40	22	0.45	.43	30	.41	.38
7		.42	15		.35	23	.48	.41	31		.44
8		.42	16		.39	24	.48	.41			

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in John Day drainage basin during 1907 and 1908:

Miscellaneous measurements in John Day River drainage basin, Oregon, in 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
July 11, 1907	John Day River	Columbia River	Margaret or Thompson Springs	61
August 11, 1908	do	do	Prairie City	50
July 11, 1907	do	do	do	111
July 9, 1907	do	do	John Day	178
July 8, 1907	do	do	7 miles above Dayville	226
July 7, 1907	do	do	5 miles below Dayville	292
July 6, 1907	do	do	Spray	1,170
July 12, 1907	Paps Creek	do	Sec. 26, T. 13 S., R. 34 E	14
July 11, 1907	Strawberry Creek	do	Sec. 12, T. 13 S., R. 33 E	30
Do	Indian Creek	do	Sec. 18, T. 13 S., R. 33 E	32
July 9, 1907	Flume to electric light plant.	John Day River	John Day	12
August 11, 1908	Canyon Creek	do	Canyon City	3
July 9, 1907	do	do	One-half mile above John Day	46
July 7, 1907	South Fork of John Day River.	do	1 mile above Dayville	56
November 22, 1908	Dayville ditch	South Fork of John Day River.	Dayville, opposite gaging station	[a] .9
July 12, 1907	Middle Fork of John Day River.	John Day River	Austin	5
July 17, 1907	do	do	Sec. 34, T. 9 S., R. 32 E	58
July 18, 1907	do	do	Ritter	90
Do	North Fork of John Day River.	do	Monument	516
July 13, 1907	Granite Creek	North Fork of John Day River.	Granite	14

[a] Water surface 1.9 feet below white mark on rock on left bank of ditch at gaging station.

DESCHUTES RIVER DRAINAGE BASIN.

DESCRIPTION.

Deschutes River has its source in a number of mountain lakes at the summit of the Cascades just over the mountains from the headwaters of Willamette River, and its course is northward to the Columbia, which it enters about 15 miles above The Dalles.

The principal tributaries of Deschutes River are White, Warm Springs, Metolius, and Crooked rivers, and the West Fork of the Deschutes. All except the Crooked River drain the eastern slope of the Cascades and contribute the larger portion of the stream flow. The entire drainage area of the system is 9,180 square miles, distributed as follows:

	Square miles.
Deschutes River at Bend	1,530
Deschutes River above the mouth of the Crooked River	2,520
Deschutes River at Sherar Bridge	8,750
Deschutes River above Lava post-office (locally known as Little River)	720
Crooked River	2,920
East Fork of Deschutes River	200
West Fork of Deschutes River	500

Topographically, the area is rough and mountainous. The agricultural lands consist largely of high table-lands cut by deep canyons through which the rivers flow, and small arable areas which border the streams. The soil is a coarse disintegrated lava. The rocks of the entire area are volcanic and so peculiarly porous that the basin has the effect of a huge sponge. Deschutes River has perhaps the most remarkably uniform flow of any river comparable with it in size, and its economic value is almost incalculable. At the mouth of the stream the maximum flow is only six times the minimum. Ocular evidence of this uniformity of flow is presented by the low grass-grown banks between which the river flows for its entire course.

The general elevation of the lands around Bend is 3,600 feet above sea level; that of the summit of the Cascade Mountains is from 5,000 to 6,000 feet. Prineville is 2,868 feet above sea level, and Paulina, near the upper portion of the Crooked River drainage basin, 3,684 feet.

The only timbered portion of this drainage basin is found on the eastern slope of the Cascades, and constitutes about 15 per cent of the total area. The divide between Crooked River and the John Day basin is sparsely timbered. The uniform flow of this stream can not be attributed to forestation. Indeed the entire timber supply could be removed without in the least affecting the flow of the river.

The annual rainfall varies from 100 inches on the summit of the Cascade Mountains to 10 inches along the main course of the stream. Twenty-five miles farther east, at Prineville, the mean annual rainfall is 9 inches; at Warm Springs, 11 inches; at Bend, 15 inches. On the headwaters of Crooked River the precipitation is probably 20 inches or more.

Although the winter temperatures are low, ice conditions do not affect the determination of stream flow to any extent. This is due to the fact that the waters reach the river in the form of springs. The high stages usually occur in July and result from the melting of snows in the mountains, although occasionally floods are caused by "chinook" winds in the early spring or late fall.

It has been estimated that Deschutes River alone from Bend to mouth, a distance of 140 miles, is capable of furnishing a million horsepower, and by including such tributaries as White and Metolius rivers and the West Fork, this figure may probably be raised to a million and a half. Power plants need fear neither shortage of water during the summer months nor damage from flood. During the low-water period, throughout the lower 130 miles of the river's course, it flows in a narrow canyon with an average fall of 20 feet to the mile, and conditions are such that a succession of dams could be built almost throughout its entire length.

11947—10——20

The following gaging stations have been maintained in this drainage basin:

Deschutes River at Allen's ranch, near Lava (Little River) (1905 and 1908).
Deschutes River at West's ranch near Lava (1906 to 1908).
Deschutes River at Bend (1904 to 1908).
Deschutes River near Moro (1897, 1898, and 1899).
Deschutes River near Biggs (1906 to 1908).
East Fork of Deschutes River at Crescent (1904 to 1908).
West Fork of Deschutes River (Big River) near Lava (1905 to 1907).
Tumalo Creek near Laidlaw and Bend (1906, 1907, and 1908).
Lewis Creek near Laidlaw, Oreg. (1908).
Squaw Creek near Sisters (1907 and 1908).
Crooked River near Post (1908).
Crooked River near Prineville (1908).
Ochoco Creek near Prineville (1908).
Metolius River near Sisters (1908).

DESCHUTES RIVER AT ALLEN'S RANCH, NEAR LAVA, OREG.

This station, which was established February 17, 1905, is located one-half mile above the mouth of the West Fork at C. B. Allen's ranch, 1 mile north of Lava. The stream at this point is locally known as Little River. The data obtained here are particularly valuable in connection with irrigation development and in a general study of the run-off factors of this very interesting area.

The datum of the gage has not been changed since the station was established, but the records are not as accurate as could be wished. During the summer months a very troublesome growth of weeds appears in the river in the vicinity of the station, and as the season advances these weeds greatly retard the water and create backwater conditions at the gage. Discharges for 1908 have therefore been obtained by an indirect method, similar to that used for shifting channels. Where a sufficient number of measurements are made this method will give fairly reliable results, but as only a few have been made at this station, the results are liable to error. Prior to 1908 a curve averaging all the measurements was made.

Discharge measurements of Deschutes River at Allen's ranch, near Lava, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	I. E. Oakes	60	212	6.62	377
April 9	do	63	236	7.02	415
1908.					
March 27	H. D. McGlashan	58	189	6.38	335
April 5	do	58	170	6.04	277
June 22	do	68	237	7.13	406
October 25	R. B. Post	57	142	5.90	178

Daily gage height, in feet, of Deschutes River at Allen's ranch, near Lava, Oreg., for 1907 and 1908.

[Mrs. C. B. Allen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	5.3	6.6	7.0	6.5	8.0	7.5	6.9	6.25	6.1	5.8	5.7	5.95
2	5.3	6.75	6.9	6.55	8.0	7.5	6.85	6.25	6.1	5.8	5.7	5.85
3	5.7	6.9	6.8	6.55	7.95	7.5	6.85	6.25	6.1	5.8	5.7	5.7
4	6.1	7.1	6.7	6.5	7.85	7.55	6.85	6.2	6.05	5.8	5.7	5.7
5	6.6	7.55	6.65	6.45	7.8	7.6	6.85	6.15	6.1	5.8	5.7	5.7
6	6.45	7.9	6.6	6.55	7.75	7.65	6.8	6.15	6.1	5.75	5.65	5.75
7	6.4	7.95	6.6	6.7	7.7	7.7	6.75	6.15	6.1	5.75	5.65	5.75
8	6.4	8.0	6.6	6.8	7.65	7.75	6.75	6.15	6.0	5.75	5.6	5.8
9	6.35	9.65	6.6	7.0	7.6	7.75	6.75	6.15	6.0	5.7	5.6	5.8
10	6.2	10.58	6.6	7.2	7.65	7.75	6.75	6.2	6.0	5.7	5.6	5.8
11	6.2	10.1	6.6	7.35	7.7	7.75	6.75	6.25	5.95	5.7	5.6	5.85
12	6.15	9.6	6.5	7.45	7.7	7.7	6.75	6.2	5.9	5.7	5.6	6.0
13	6.15	9.35	6.4	7.55	7.75	7.65	6.7	6.15	5.9	5.7	5.6	5.9
14	6.05	9.3	6.35	7.65	7.8	7.6	6.7	6.15	5.9	5.7	5.6	5.8
15	5.9	8.75	6.3	7.7	7.85	7.6	6.65	6.15	5.9	5.7	5.6	5.9
16	6.0	8.55	6.2	7.65	7.85	7.6	6.6	6.1	5.9	5.7	5.6	6.0
17	5.95	8.45	6.3	7.65	7.8	7.55	6.6	6.05	5.95	5.7	5.6	6.1
18	5.95	7.9	6.6	7.7	7.7	7.5	6.5	6.05	5.95	5.65	5.55	6.0
19	6.05	7.45	6.85	7.75	7.6	7.35	6.5	6.05	5.95	5.65	5.55	5.95
20	6.1	7.35	7.15	7.75	7.6	7.25	6.45	6.05	5.95	5.65	5.6	5.95
21	6.05	7.25	7.2	7.8	7.7	7.1	6.45	6.0	5.9	5.65	5.65	5.95
22	6.0	7.25	7.25	7.8	7.85	7.0	6.45	6.0	5.9	5.65	5.7	6.55
23	5.9	7.25	7.15	7.8	7.95	7.0	6.45	6.0	5.9	5.65	5.7	6.75
24	5.9	7.1	6.7	7.85	8.05	7.0	6.35	6.05	5.85	5.65	5.75	7.05
25	5.95	7.1	6.7	7.85	8.1	7.0	6.35	6.1	5.8	5.65	5.75	7.5
26	6.0	7.05	6.6	7.9	8.1	7.0	6.35	6.15	5.8	5.65	5.8	7.6
27	6.0	7.1	6.5	7.9	8.0	6.9	6.35	6.1	5.8	5.65	5.8	7.6
28	6.05	7.1	6.45	7.95	7.85	6.9	6.35	6.05	5.85	5.65	5.85	7.5
29	6.1	.....	6.4	8.0	7.7	6.9	6.3	6.05	5.85	5.7	5.85	7.3
30	6.2	.....	6.35	8.0	7.65	6.9	6.3	6.05	5.85	5.7	5.9	7.1
31	6.35	.....	6.35	.....	7.55	.....	6.25	6.0	.....	5.7	.....	7.1
1908.[b]												
1	7.0	.....	5.7	6.0	7.35	6.5	6.65	6.1	5.8	5.6	5.9	5.75
2	7.0	.....	5.55	5.95	7.0	6.5	6.65	6.1	5.75	5.6	5.9	5.7
3	6.9	.....	5.5	5.9	6.9	6.5	6.65	6.05	5.7	5.6	5.85	5.7
4	6.8	.....	5.5	5.95	7.05	6.5	6.65	6.05	5.7	5.6	5.8	5.65
5	.....	.....	5.5	5.9	7.1	6.45	6.65	6.0	5.7	5.6	5.75	5.6
6	.....	.....	5.4	5.95	7.1	6.4	6.65	6.0	5.7	5.55	5.7	5.5
7	.....	.....	5.4	6.0	7.1	6.4	6.65	6.0	5.7	5.55	5.7	5.5
8	.....	.....	5.4	6.0	7.1	6.45	6.6	6.0	5.7	5.5	5.65	5.6
9	.....	.....	5.4	6.0	7.1	6.5	6.6	6.0	5.7	5.5	5.65	5.5
10	.....	.....	5.45	6.1	7.1	6.5	6.6	5.9	5.7	5.5	5.6	5.5
11	.....	.....	5.5	6.2	7.05	6.6	6.55	5.85	5.7	5.5	5.6	5.55
12	.....	.....	5.6	6.3	7.0	6.75	6.55	5.85	5.7	5.5	5.6	5.5
13	.....	.....	5.65	6.4	7.0	6.8	6.65	5.85	5.7	5.5	5.6	5.6
14	.....	.....	5.85	6.5	7.0	6.85	6.7	5.9	5.7	5.8	5.55	5.5
15	.....	.....	6.15	6.6	7.05	6.9	6.75	5.9	5.7	6.2	5.55	5.5
16	.....	.....	6.45	6.7	7.1	6.9	6.7	5.9	5.7	6.65	5.55	5.5
17	.....	.....	6.7	6.75	7.1	6.9	6.6	5.85	5.7	6.8	5.55	5.6
18	.....	.....	6.9	6.8	7.0	7.0	6.6	5.8	5.7	6.6	5.55	5.6
19	.....	.....	6.8	6.85	6.9	7.0	6.55	5.8	5.8	6.45	5.6	5.6
20	.....	.....	6.6	6.9	6.85	7.1	6.45	5.8	5.7	6.3	5.7	5.55
21	.....	.....	6.4	7.0	6.8	7.1	6.45	5.8	6.5	6.2	5.8	5.55
22	.....	.....	6.3	7.1	6.7	7.15	6.55	5.8	6.5	6.1	6.1	5.55
23	.....	.....	6.3	7.2	6.65	7.2	6.6	5.75	6.5	6.0	6.15	5.6
24	.....	.....	6.3	7.35	6.6	7.15	6.5	5.75	5.7	5.95	6.1	5.6
25	.....	.....	6.4	7.4	6.5	6.95	6.45	5.75	5.7	5.9	6.0	5.6
26	.....	.....	6.45	7.5	6.5	6.85	6.4	5.75	5.7	5.85	5.9	5.55
27	.....	.....	6.4	7.55	6.45	6.8	6.3	5.75	6.0	5.8	5.7	5.6
28	.....	.....	6.2	7.5	6.45	6.7	6.3	5.75	6.0	5.8	5.6	5.7
29	.....	.....	6.1	7.35	6.45	6.65	6.2	5.75	5.0	5.8	5.65	5.8
30	.....	.....	6.05	7.2	6.45	6.65	6.15	5.8	6.0	5.8	5.8	5.8
31	.....	.....	6.05	.....	6.5	.....	6.15	5.8	.....	5.8	.....	5.8

[a] River frozen from January 6 to February 9. Maximum thickness of ice 8 inches.
[b] Ice along banks December 13 to 18. River frozen over December 19 to 31; maximum thickness of ice about 5 inches.

Rating table for Deschutes River at Allen's ranch, near Lava, Oreg., for 1905 to 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.30	115	6.50	305	7.70	658	8.90	1,130
5.40	125	6.60	329	7.80	694	9.00	1,170
5.50	135	6.70	355	7.90	732	9.20	1,256
5.60	147	6.80	382	8.00	770	9.40	1,342
5.70	160	6.90	410	8.10	810	9.60	1,428
5.80	173	7.00	439	8.20	850	9.80	1,514
5.90	188	7.10	468	8.30	890	10.00	1,600
6.00	205	7.20	498	8.40	930	10.20	1,700
6.10	223	7.30	528	8.50	970	10.40	1,800
6.20	242	7.40	559	8.60	1,010	10.60	1,900
6.30	262	7.50	591	8.70	1,050	10.80	2,000
6.40	283	7.60	624	8.80	1,090	11.00	2,100

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 13 discharge measurements made during 1905–1907, and is not well defined for 1907.

Daily discharge, in second-feet, of Deschutes River at Allen's ranch, near Lava, Oreg., for 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	520	.....	176	242	592	294	294	166	130	120	188	196
2	520	.....	173	232	468	294	294	166	125	120	188	188
3	485	.....	166	223	436	294	294	160	120	125	180	188
4	452	.....	166	232	485	294	283	160	120	125	173	180
5	.....	.....	166	223	502	283	283	154	120	125	166	173
6	.....	.....	154	232	502	262	283	154	120	120	160	160
7	.....	.....	154	242	502	262	283	154	120	120	166	166
8	.....	.....	154	242	502	272	272	154	120	115	160	180
9	.....	.....	154	242	485	283	272	154	120	115	160	166
10	.....	.....	160	262	485	283	272	141	120	115	154	166
11	.....	.....	166	283	468	305	262	135	120	120	154	173
12	.....	.....	180	305	456	340	252	135	120	120	154	166
13	.....	.....	405	328	456	352	272	135	120	120	154	180
14	.....	.....	223	352	456	365	283	141	120	154	154	166
15	.....	.....	283	378	468	378	294	141	120	214	154	166
16	.....	.....	352	405	485	365	283	141	125	305	154	166
17	.....	.....	420	420	485	365	262	135	125	340	154	180
18	.....	.....	485	436	436	392	262	130	125	305	154	180
19	.....	.....	452	452	405	392	252	130	141	272	160	180
20	.....	.....	392	468	392	420	232	130	125	242	173	173
21	.....	.....	340	502	378	420	232	130	242	223	196	173
22	.....	.....	316	520	352	436	252	130	242	205	252	173
23	.....	.....	316	555	340	452	262	130	242	188	262	180
24	.....	.....	316	610	328	436	242	125	125	180	252	180
25	.....	.....	340	629	305	365	232	125	125	180	232	180
26	.....	.....	352	668	305	340	223	125	130	173	214	173
27	.....	.....	340	687	294	328	205	125	166	166	180	180
28	.....	.....	294	668	283	305	205	125	166	166	166	196
29	.....	.....	272	610	283	294	188	125	166	166	180	214
30	.....	.....	262	555	283	294	180	130	166	173	205	214
31	.....	.....	262	.....	294	.....	180	130	.....	173	.....	214

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Deschutes River at Allen's ranch, near Lava, Oreg., for 1907 and 1908.

[Drainage area, 880 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January [a]	329	115	220	0.250	0.29	13,500	C.
February [a]	1,890	329	793	.902	.94	44,000	C.
March	513	242	345	.392	.45	21,200	C.
April	770	294	570	.648	.72	33,900	B.
May	810	608	696	.791	.91	42,800	B.
June	676	410	558	.634	.71	33,200	C.
July	410	252	330	.375	.43	20,300	C.
August	252	205	227	.258	.30	14,000	C.
September	223	173	196	.223	.25	11,700	C.
October	173	154	161	.183	.21	9,900	C.
November	188	141	157	.178	.20	9,340	C.
December	624	160	287	.326	.38	17,600	C.
The year	1,890	115	378	.431	5.79	271,000	
1908.							
January			[b] 300	.341	.39	18,400	D.
February			[b] 170	.193	.21	9,780	D.
March	485	154	271	.308	.36	16,700	C.
April	687	223	407	.462	.52	24,200	C.
May	592	283	416	.473	.55	25,600	C.
June	452	262	339	.385	.43	20,200	C.
July	294	180	254	.289	.33	15,600	C.
August	166	125	139	.158	.18	8,550	C.
September	242	120	141	.160	.18	8,390	C.
October	340	115	174	.198	.23	10,700	C.
November	262	154	180	.205	.23	10,700	C.
December	214	160	180	.205	.24	11,100	C.
The year	687	115	248	.281	3.85	180,000	

[a] No correction made for ice conditions; discharges are probably somewhat too large.
[b] Estimated.

DESCHUTES RIVER AT WEST'S RANCH, NEAR LAVA, OREG.

This station was established June 20, 1906, at a private bridge on West's ranch, 18 miles above Bend. It is just below the mouth of Spring River and about 1½ miles below the mouth of West Fork.

This station affords exceptionally good conditions and the results are above the average in accuracy. It is located above all present diversions from the stream and furnishes the requisite data for determining the quantity of water available for irrigation of lands in the Deschutes Valley. At present two large canals are operated under the provisions of the Carey Act by the Deschutes Irrigation and Power Company. The complete reclamation of all land segregated under this law will bring the total to 225,000 acres under irrigation.

The river at this point never freezes, as the stream is entirely spring-fed, and although the stream is used for logging, the channel is deep and the current swift and gaging operations are not affected. The gage datum has not been changed since the station was installed, and the records are continuous.

Discharge measurements of Deschutes River at West's ranch, near Lava, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
April 10	I. E. Oakes	115	656	9.60	2,120
1908.					
March 26	H. D. McGlashan	110	594	9.30	1,780
April 5	do	110	570	9.10	1,620
October 25	R. B. Post	108	598	9.15	1,660

Daily gage height, in feet, of Deschutes River at West's ranch, near Lava, Oreg., for 1907 and 1908.

[B. F. West, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	8.80	9.00	9.38	9.18	9.95	9.90	9.60	9.40	9.35	9.20	9.10	9.08
2	8.75	9.00	9.32	9.20	9.95	9.90	9.60	9.40	9.35	9.15	9.10	9.05
3	8.80	9.02	9.30	9.20	9.95	9.90	9.60	9.40	9.35	9.15	9.05	9.02
4	8.85	9.22	9.25	9.20	9.92	9.90	9.60	9.40	9.35	9.15	9.05	9.00
5	8.85	9.45	9.20	9.20	9.90	9.90	9.60	9.38	9.35	9.15	9.05	9.05
6	8.92	9.60	9.20	9.28	9.90	9.90	9.58	9.35	9.35	9.15	9.05	9.05
7	8.85	9.55	9.20	9.38	9.90	9.90	9.55	9.35	9.30	9.15	9.05	9.00
8	8.92	9.58	9.20	9.45	9.90	9.90	9.55	9.38	9.30	9.15	9.05	9.05
9	8.88	9.70	9.20	9.52	9.88	9.90	9.55	9.40	9.30	9.15	9.05	9.05
10	8.90	11.15	9.20	9.60	9.88	9.92	9.55	9.40	9.30	9.15	9.05	9.05
11	9.00	10.90	9.20	9.62	9.90	9.95	9.55	9.40	9.30	9.15	9.05	9.05
12	8.90	10.70	9.20	9.65	9.92	9.98	9.55	9.40	9.28	9.15	9.05	9.08
13	8.88	10.58	9.15	9.70	9.95	9.95	9.55	9.40	9.25	9.15	9.00	9.15
14	8.75	10.40	9.10	9.72	9.95	9.95	9.50	9.40	9.25	9.15	9.05	9.00
15	8.48	10.15	9.10	9.75	9.95	9.90	9.50	9.35	9.25	9.10	9.05	8.95
16	8.85	10.05	9.10	9.75	9.95	9.90	9.50	9.35	9.25	9.10	9.05	8.95
17	8.82	9.98	9.10	9.75	9.95	9.90	9.50	9.35	9.25	9.10	9.05	9.00
18	8.85	9.82	9.32	9.75	9.92	9.80	9.50	9.35	9.25	9.10	9.00	9.00
19	9.02	9.60	9.38	9.80	9.95	9.75	9.50	9.35	9.25	9.10	9.00	9.00
20	9.10	9.55	9.52	9.80	9.95	9.70	9.50	9.32	9.25	9.10	9.02	9.00
21	8.88	9.50	9.55	9.80	9.95	9.68	9.50	9.30	9.25	9.10	9.05	9.05
22	8.80	9.50	9.50	9.80	10.00	9.65	9.45	9.30	9.25	9.10	9.05	9.40
23	8.80	9.50	9.42	9.85	10.05	9.65	9.45	9.30	9.22	9.08	9.05	9.55
24	8.78	9.45	9.32	9.85	10.08	9.65	9.45	9.35	9.20	9.10	9.10	9.75
25	8.80	9.50	9.28	9.88	10.10	9.65	9.45	9.35	9.20	9.10	9.10	9.85
26	8.80	9.50	9.25	9.90	10.10	9.65	9.45	9.40	9.20	9.10	9.15	10.00
27	8.80	9.45	9.20	9.90	10.08	9.68	9.45	9.35	9.20	9.10	9.20	9.85
28	8.80	9.40	9.20	9.92	10.02	9.68	9.45	9.35	9.25	9.10	9.20	9.80
29	8.82	.....	9.15	9.95	9.95	9.65	9.45	9.35	9.20	9.10	9.15	9.70
30	8.85	.....	9.15	9.95	9.90	9.60	9.45	9.35	9.20	9.10	9.10	9.55
31	8.90	.....	9.15	.....	9.90	.....	9.40	9.35	.....	9.10	.....	9.55
1908.												
1	9.55	8.70	8.90	9.10	9.60	9.40	9.45	9.25	9.15	9.05	9.10	.....
2	9.55	8.92	8.88	9.05	9.58	9.40	9.45	9.25	9.15	9.05	9.10	.....
3	9.45	8.90	8.85	9.05	9.55	9.40	9.44	9.25	9.15	9.05	9.10	9.00
4	9.45	8.95	8.85	9.08	9.55	9.40	9.45	9.20	9.15	9.05	9.10	9.00
5	9.40	8.95	8.85	9.10	9.55	9.40	9.45	9.20	9.15	9.05	9.05	9.00
6	9.28	9.00	8.85	9.10	9.55	9.35	9.45	9.20	9.15	9.05	9.05	9.00
7	9.25	9.00	8.82	9.10	9.60	9.35	9.40	9.20	9.15	9.05	9.05	8.95
8	9.30	8.98	8.80	9.05	9.60	9.38	9.40	9.20	9.15	9.05	9.02	8.95
9	9.30	8.95	8.82	9.08	9.60	9.40	9.40	9.20	9.10	9.05	9.00	8.95
10	9.22	8.95	8.82	9.12	9.60	9.42	9.40	9.20	9.10	9.05	9.00	8.92
11	9.25	8.95	8.85	9.12	9.60	9.45	9.40	9.20	9.10	9.05	9.00	8.85
12	9.25	8.90	8.90	9.18	9.55	9.48	9.40	9.15	9.10	9.05	9.00	8.90
13	9.18	8.85	8.92	9.28	9.55	9.50	9.45	9.15	9.10	9.05	9.00	8.95
14	9.25	8.88	9.02	9.30	9.58	9.52	9.50	9.20	9.15	9.18	.....	8.88
15	9.25	8.90	9.20	9.38	9.60	9.55	9.45	9.20	9.15	9.40	9.00	8.82
16	9.20	8.90	9.35	9.45	9.60	9.55	9.45	9.15	9.15	9.40	9.00	8.85
17	9.15	8.92	9.42	9.45	9.60	9.55	9.40	9.15	9.15	9.40	9.00	8.85
18	9.15	8.95	9.45	9.45	9.60	9.60	9.40	9.15	9.15	9.40	9.00	8.50
19	9.15	8.98	9.40	9.50	9.55	9.60	9.35	9.15	9.10	9.38	9.00	8.60
20	9.15	8.88	9.30	9.50	9.55	9.62	9.35	9.15	9.10	9.30	9.08	8.80

Daily gage height, in feet, of Deschutes River at West's ranch, near Lava, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21	9.15	8.80	9.20	9.60	9.52	9.65	9.35	9.15	9.10	9.28	9.15	8.95
22	8.98	8.90	9.20	9.60	9.48	9.65	9.40	9.15	9.10	9.25	9.18	8.90
23	9.05	8.85	9.20	9.65	9.45	9.65	9.45	9.15	9.10	9.20	9.20	8.90
24	9.05	8.85	9.22	9.70	9.40	9.60	9.38	9.15	9.05	9.18	9.20	8.90
25	9.08	8.85	9.28	9.70	9.40	9.50	9.35	9.15	9.05	9.15	9.15	8.85
26	9.05	8.88	9.30	9.70	9.40	9.50	9.30	9.15	9.05	9.15	9.15	8.85
27	9.02	8.92	9.30	9.70	9.35	9.48	9.30	9.15	9.05	9.10	9.00	8.85
28	9.00	8.95	9.20	9.70	9.35	9.45	9.30	9.15	9.05	9.10	.....	8.90
29	8.98	8.90	9.20	9.65	9.35	9.45	9.30	9.15	9.05	9.10	.....	8.95
30	9.02	.....	9.10	9.60	9.38	9.45	9.25	9.15	9.05	9.10	.....	8.90
31	8.85	.....	9.10	.....	9.40	.....	9.25	9.15	.....	9.10	.....	8.90

NOTE.—No ice at this station.

Rating table for Deschutes River at West's ranch, near Lava, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
8.40	1,120	9.20	1,700	10.00	2,560	10.80	3,550
8.50	1,170	9.30	1,800	10.10	2,680	10.90	3,680
8.60	1,225	9.40	1,900	10.20	2,800	11.00	3,810
8.70	1,285	9.50	2,010	10.30	2,920	11.10	3,940
8.80	1,350	9.60	2,120	10.40	3,040	11.20	4,070
8.90	1,430	9.70	2,230	10.50	3,165		
9.00	1,520	9.80	2,340	10.60	3,290		
9.10	1,610	9.90	2,450	10.70	3,420		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 9 discharge measurements made during 1906–1908, and is well defined between gage heights 8.8 feet and 9.6 feet.

Monthly discharge of Deschutes River at West's ranch, near Lava, Oreg., for 1907 and 1908.

[Drainage area, 1,240 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth, in inches, on drainage area.	Total in acre-feet.	
1907.							
January	1,610	1,160	1,390	1.12	1.29	85,500	A.
February	4,000	1,520	2,300	1.85	1.93	128,000	A.
March	2,060	1,610	1,750	1.41	1.63	108,000	A.
April	2,500	1,680	2,170	1.75	1.95	129,000	A.
May	2,680	2,430	2,510	2.02	2.33	154,000	A.
June	2,540	2,120	2,350	1.90	2.12	140,000	A.
July	2,120	1,900	2,020	1.63	1.88	124,000	A.
August	1,900	1,800	1,860	1.50	1.73	114,000	A.
September	1,850	1,700	1,770	1.43	1.60	105,000	A.
October	1,700	1,590	1,630	1.31	1.51	100,000	A.
November	1,700	1,520	1,580	1.27	1.42	94,000	A.
December	2,560	1,480	1,770	1.43	1.65	109,000	A.
The year	4,000	1,160	1,920	1.55	21.04	1,390,000	
1908.							
January	2,060	1,390	1,700	1.37	1.58	105,000	A.
February	1,520	1,280	1,440	1.16	1.25	82,800	A.
March	1,960	1,350	1,600	1.29	1.49	98,400	A.
April	2,230	1,560	1,880	1.52	1.70	112,000	A.
May	2,120	1,850	2,030	1.64	1.89	125,000	A.
June	2,180	1,850	2,000	1.61	1.80	119,000	A.
July	2,010	1,750	1,890	1.52	1.75	116,000	A.
August	1,750	1,660	1,680	1.35	1.56	103,000	A.
September	1,660	1,560	1,620	1.31	1.46	96,400	A.
October	1,900	1,560	1,660	1.34	1.54	102,000	A.
November	1,700	1,520	1,570	1.27	1.42	93,400	A.
December	1,520	1,170	1,430	1.15	1.33	87,900	A.
The year	2,230	1,170	1,710	1.38	18.77	1,240,000	

DESCHUTES RIVER AT BEND, OREG.

This station was established at Sizemore's bridge December 22, 1904. Although data were published for 1905 and 1906, they are not at all reliable. The conditions at the station are not favorable for accurate results, as the channel is comparatively shallow and exceedingly rough, and the gage heights are influenced by back water from saw logs impounded at a mill below the station. On March 30, 1907, gage records were suspended at this point and on April 23, 1907, they were begun at Staat's bridge in the town of Bend. The conditions at this bridge, however, are no better than they were at the former location, and discharge measurements are inconsistent. The records of gage heights, which are furnished without cost to the U. S. Geological Survey by Mr. C. A. Stanburrough, engineer of the city pumping plant, are published as being of general interest in the study of the river system. The discharge at this point is practically the same as at West's ranch.

Discharge measurements of Deschutes River at Bend, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
April 4 [a]	I. E. Oakes	370	687	1.65	1,650
April 15 [b]	do	105	806	.....	2,040
1908.					
April 3 [b]	H. D. McGlashan	104	767	1.38	1,630
June 28 [b]	do	104	767	1.36	1,490

[a] At Sizemore's bridge. [b] At Staat's bridge.

Daily gage height, in feet, of Deschutes River at Bend, Oreg., for 1907 and 1908.

[C. A. Stanburrough, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	.....	1.60	1.70	.....	1.90	1.75	1.80	1.35	1.42	1.38	1.52	1.40
2	.....	1.55	1.70	.....	1.90	1.68	1.70	1.35	1.45	1.40	1.30	1.40
3	.....	1.55	1.70	.....	1.90	1.70	1.48	1.35	1.40	1.35	1.30	1.40
4	.....	1.70	1.70	.....	1.88	1.70	1.50	1.35	1.40	1.35	1.30	1.40
5	.....	1.85	1.70	.....	1.85	1.70	1.48	1.32	1.40	1.38	1.28	1.40
6	.....	1.90	1.70	.....	1.80	1.70	1.45	1.30	1.40	1.35	1.25	1.40
7	.....	1.90	1.70	.....	1.80	1.70	1.50	1.32	1.40	1.32	1.32	1.40
8	.....	1.90	1.70	.....	1.80	1.75	1.78	1.32	1.40	1.48	1.30	1.40
9	.....	1.90	1.70	.....	1.75	1.75	1.75	1.35	1.40	1.50	1.50	1.40
10	.....	2.25	1.70	.....	1.75	1.72	1.75	1.35	1.40	1.45	1.25	1.40
11	.....	2.45	1.70	.....	1.78	1.72	1.75	1.38	1.40	1.38	1.30	1.42
12	.....	2.35	1.65	.....	1.80	1.72	1.72	1.35	1.40	1.42	1.28	1.42
13	.....	2.25	1.65	.....	1.80	1.70	1.75	1.35	1.38	1.32	1.35	1.42
14	.....	2.25	1.60	.....	1.80	1.70	1.65	1.35	1.38	1.38	1.40	1.45
15	.....	2.10	1.60	.....	1.80	1.70	1.60	1.35	1.35	1.35	1.40	1.35
16	.....	2.00	1.60	.....	1.80	1.70	1.45	1.35	1.40	1.30	1.35	1.32
17	.....	2.00	1.60	.....	1.80	1.70	1.40	1.35	1.38	1.32	1.30	1.40
18	1.60	1.90	1.65	.....	1.80	1.68	1.40	1.35	1.40	1.50	1.35	1.45
19	1.60	1.80	1.70	.....	1.80	1.62	1.40	1.35	1.40	1.45	1.38	1.45
20	1.65	1.80	1.80	.....	1.80	1.60	1.38	1.35	1.35	1.30	1.40	1.45

Daily gage height, in feet, of Deschutes River at Bend, Oreg., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	1.55	1.80	1.80	.....	1.80	1.60	1.40	1.32	1.45	1.30	1.40	1.45
22	1.50	1.80	1.80	.....	1.80	1.55	1.38	1.30	1.35	1.28	1.40	1.62
23	1.50	1.80	1.80	1.85	1.80	1.55	1.38	1.30	1.38	1.30	1.40	1.75
24	1.50	1.80	1.80	1.85	1.85	1.55	1.38	1.38	1.38	1.30	1.40	1.80
25	1.50	1.80	1.75	1.85	1.85	1.52	1.35	1.35	1.38	1.30	1.40	1.85
26	1.50	1.80	1.70	1.85	1.85	1.50	1.38	1.38	1.35	1.30	1.40	1.85
27	1.50	1.80	1.70	1.85	1.85	1.52	1.38	1.38	1.32	1.25	1.45	1.80
28	1.50	1.75	1.70	1.85	1.85	1.52	1.38	1.40	1.38	1.30	1.40	1.90
29	1.50	.....	1.65	1.85	1.82	1.50	1.38	1.40	1.35	1.30	1.40	1.88
30	1.50	.....	1.60	1.85	1.80	1.50	1.35	1.40	1.35	1.30	1.40	1.85
31	1.50	.....	.....	.....	1.78	.....	1.32	1.40	.....	1.30	.....	1.85
1908.												
1	1.85	1.30	1.35	1.40	1.58	1.40	1.36	1.14	1.15	1.15	1.34	1.41
2	1.80	1.38	1.35	1.40	1.58	1.45	1.32	1.16	1.26	1.19	1.35	1.42
3	1.78	1.45	1.35	1.39	1.58	1.45	1.31	1.16	1.25	1.22	1.36	1.45
4	1.72	1.45	1.35	1.39	1.60	1.40	1.31	1.15	1.14	1.19	1.38	1.44
5	1.75	1.48	1.40	1.41	1.58	1.39	1.30	1.12	1.15	1.18	1.45	1.43
6	1.58	1.38	1.40	1.40	1.55	1.38	1.30	1.11	1.15	1.18	1.50	1.42
7	1.60	1.35	1.35	1.40	1.57	1.38	1.28	1.09	1.18	1.19	1.50	1.40
8	1.70	1.32	1.25	1.40	1.60	1.39	1.29	1.09	1.16	1.19	1.34	1.38
9	1.60	1.32	1.20	1.40	1.64	1.38	1.29	1.09	1.19	1.19	1.46	1.40
10	1.55	1.38	1.20	1.41	1.58	1.40	1.26	1.05	1.20	1.24	1.45	1.40
11	1.60	1.50	1.30	1.46	1.56	1.40	1.26	1.04	1.19	1.20	1.45	1.30
12	1.60	1.50	1.35	1.50	1.55	1.40	1.25	1.02	1.18	1.20	1.45	1.25
13	1.60	1.40	1.35	1.50	1.55	1.40	1.25	1.04	1.18	1.20	1.42	1.35
14	1.60	1.42	1.42	1.52	1.55	1.42	1.27	1.11	1.18	1.32	1.34	1.39
15	1.58	1.40	1.50	1.52	1.60	1.44	1.25	1.15	1.19	1.42	1.30	1.36
16	1.48	1.40	1.60	1.55	1.58	1.44	1.27	1.12	1.20	1.42	1.34	1.35
17	1.45	1.40	1.65	1.58	1.60	1.45	1.26	1.11	1.20	1.47	1.30	1.35
18	1.45	1.40	1.70	1.58	1.55	1.48	1.22	1.10	1.20	1.46	1.35	1.35
19	1.40	1.40	1.70	1.58	1.58	1.46	1.20	1.11	1.19	1.43	1.45	1.30
20	1.45	1.40	1.65	1.60	1.55	1.49	1.20	1.10	1.18	1.40	1.48	1.25
21	1.50	1.40	1.60	1.60	1.52	1.52	1.25	1.10	1.19	1.45	1.47	1.38
22	1.50	1.28	1.60	1.63	1.50	1.54	1.20	1.11	1.18	1.39	1.50	1.39
23	1.50	1.30	1.55	1.65	1.50	1.55	1.28	1.10	1.20	1.38	1.56	1.38
24	1.55	1.35	1.55	1.65	1.46	1.55	1.26	1.10	1.16	1.38	1.58	1.32
25	1.55	1.35	1.60	1.69	1.52	1.49	1.22	1.11	1.15	1.38	1.55	1.29
26	1.50	1.38	1.60	1.70	1.42	1.42	1.20	1.11	1.15	1.35	1.52	1.28
27	1.48	1.32	1.65	1.70	1.42	1.40	1.19	1.10	1.15	1.34	1.45	1.22
28	1.50	1.35	1.55	1.69	1.40	1.38	1.19	1.11	1.15	1.32	1.35	1.26
29	1.50	1.35	1.42	1.66	1.42	1.35	1.18	1.10	1.15	1.32	1.32	1.34
30	1.50	.....	1.40	1.64	1.40	1.35	1.18	1.14	1.15	1.33	1.38	1.40
31	1.42	.....	1.40	.....	1.40	.....	1.14	1.15	.....	1.35	.....	1.40

[a] Gage heights prior to March 30 are at Sizemore's bridge; after April 22 they are at Staats's bridge.

DESCHUTES RIVER NEAR BIGGS, OREG.

This station was first established October 19, 1897, at the Free Bridge and known as Deschutes River near Moro. It was discontinued December 31, 1899, and reestablished July 7, 1906, at Taylor's ranch, 1½ miles above the mouth of the river. The river at this point runs in a deep canyon, and there are no tributaries for several miles upstream. The water at this point is at present used only for an insignificant amount of irrigation.

The records at this station are directly comparable with those obtained at the Free Bridge near Moro from 1897 to 1899, although the conditions at the earlier station are not nearly so favorable for accurate results as are those in the present location.

Discharge measurements of Deschutes River near Biggs, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	I. E. Oakes	457	1,800	3.00	7,500
1908.					
June 18	H. D. McGlashan	450	1,740	2.80	6,850
October 10	L. R. Allen	444	1,570	2.38	5,360

Daily gage height, in feet, of Deschutes River near Biggs, Oreg., for 1907 and 1908.

[Wilbur Taylor, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.98	4.00				3.15			2.50			2.65
2	2.95	2.90	3.65		3.70	3.13	2.80			2.50	2.50	
3	2.82		3.60	3.40					2.50		2.50	2.64
4	3.98	2.92			3.50	3.12	2.80			2.50		
5	3.40	3.45	3.58	3.65	3.42				2.50	2.50	2.52	2.63
6	3.00	7.50		3.70		3.10	2.80			2.50		
7	2.98	6.80	3.57	3.95	3.40		2.80		2.50		2.52	2.63
8	2.95	6.00				3.09		2.50	2.50	2.50		2.63
9	2.93	5.30	3.55	4.50	3.40	3.06	2.78				2.53	2.65
10	2.90		3.50					2.50	2.50	2.50	2.53	
11	2.86	4.82	3.47	4.50	3.40	3.02	2.77	2.50				2.65
12	2.85				3.40				2.50	2.50	2.53	
13	2.75	4.54	3.32	4.50		2.98	2.76	2.50		2.50		2.68
14	2.75				3.38				2.50		2.53	2.70
15	2.65	4.20	3.28	4.40		2.93	2.73	2.50	2.50	2.50		2.70
16	2.68	4.05	3.25	4.32	3.38	2.90					2.55	
17	2.60	4.00	3.20			2.90	2.70	2.50		2.50	2.55	2.70
18	2.62			4.15	3.40							
19	2.65	4.00	3.23		3.40	2.88	2.63	2.50		2.50	2.55	2.68
20				4.05			2.60			2.50		2.65
21	2.64	4.25	4.50	4.00	3.35		2.58	2.50			2.55	2.65
22			4.75			2.85				2.50		4.10
23	2.63	4.32	4.10	4.00	3.33	2.85	2.55	2.50			2.55	
24	2.62	4.33	3.90	4.00				2.53		2.50	2.55	4.40
25		4.30		3.98	3.30	2.82	2.52	2.55			2.70	4.50
26	2.60		3.40	3.97	3.30					2.50	3.10	
27	2.63	3.95	3.12	3.95		2.82	2.50	2.50		2.50		6.00
28		3.82		3.90	3.25						2.85	5.50
29	2.63		3.05			2.80		2.50	2.50	2.50		4.00
30			3.03	3.82	3.20	2.80			2.50		2.65	3.30
31	2.63		3.04					2.50		2.50		2.90
1908.												
1		2.60		3.15								
2	3.15	2.60		3.15	3.23	2.82						2.59
3					3.21							
4	3.10	2.60		3.08		2.81						2.58
5	3.10			3.06	3.15							2.58
6		2.65				2.80						2.58
7	3.08			3.00	3.10							
8		2.65										2.58
9	3.05	2.65		3.05	3.05							
10					3.00							2.55
11	3.02	2.65		3.08								
12	3.02			3.10	2.98							2.53
13		2.65										2.50
14	3.03			3.20	2.97							
15		2.65	2.95								2.58	2.48
16	3.03	2.65	4.80	3.30	2.95						2.58	
17		2.63			2.92			2.40			2.60	2.47
18	3.03		4.65	3.50								
19	3.02	2.63		3.65	2.90			2.40			2.60	2.45
20			4.10									2.45
21	3.00	2.63	3.80	3.58	2.89			2.40			2.60	
22		2.63	3.70					2.40			2.60	2.48
23	3.00	2.62		3.50	2.87							
24			3.65		2.86						2.60	2.48
25	3.00	2.60		3.42								

Daily gage height, in feet, of Deschutes River near Biggs, Oreg., for 1907 and 1908.—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
26	2.95	.....	3.45	3.40	2.86	.....	.....	.....	.....	.....	2.60	2.48
27	.....	2.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.48
28	2.85	.....	3.38	3.35	.....	.....	.....	.....	.....	.....	2.60	.....
29	2.80	2.60	3.30	.....	2.85	.....	.....	.....	.....	.....	.....	2.50
30	.....	.....	.....	3.28	2.85	.....	.....	.....	2.37	.....	2.60	.....
31	2.65	.....	3.20	.....	2.83	.....	.....	.....	.....	.....	.....	2.50

NOTE.—There is practically no ice at this station.

Rating table for Deschutes River near Biggs, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	5,150	3.50	9,600	4.70	15,500	5.90	21,650
2.40	5,400	3.60	10,050	4.80	16,000	6.00	22,200
2.50	5,700	3.70	10,500	4.90	16,500	6.20	23,300
2.60	6,000	3.80	11,000	5.00	17,000	6.40	24,400
2.70	6,375	3.90	11,500	5.10	17,500	6.60	25,500
2.80	6,750	4.00	12,000	5.20	18,000	6.80	26,600
2.90	7,125	4.10	12,500	5.30	18,500	7.00	27,700
3.00	7,500	4.20	13,000	5.40	19,000	7.20	28,800
3.10	7,900	4.30	13,500	5.50	19,500	7.40	30,000
3.20	8,300	4.40	14,000	5.60	20,000	7.60	31,200
3.30	8,700	4.50	14,500	5.70	20,550		
3.40	9,150	4.60	15,000	5.80	21,100		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 5 discharge measurements made during 1906–1908, and is well defined below gage height 3 feet.

Monthly discharge of Deschutes River near Biggs, Oreg., for 1907 and 1908.

[Drainage area, 9,180 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	11,900	6,000	6,780	0.739	0.85	417,000	A.
February	30,600	7,120	14,100	1.54	1.60	783,000	C.
March	15,800	7,620	9,760	1.06	1.22	600,000	A.
April	14,500	8,160	12,100	1.32	1.47	720,000	B.
May	10,800	8,200	9,090	.990	1.14	559,000	A.
June	8,100	6,750	7,330	.798	.89	436,000	A.
July	6,750	5,700	6,290	.685	.79	387,000	A.
August	5,850	5,700	5,710	.622	.72	351,000	A.
September	5,700	5,700	5,700	.621	.69	339,000	A.
October	5,700	5,700	5,700	.621	.72	350,000	A.
November	7,900	5,700	6,020	.656	.73	358,000	A.
December	22,200	6,110	8,800	.959	1.11	541,000	B.
The year	30,600	5,700	8,120	.884	11.93	5,840,000	
1908.							
January	8,100	6,190	7,500	.817	.94	461,000	A.
February	6,190	6,000	6,100	.664	.72	351,000	A.
March [a]	16,000	.....	8,700	.948	1.09	535,000	B.
April	10,300	7,500	8,630	.940	1.05	514,000	A.
May	8,520	6,940	7,430	.809	.93	457,000	A.
June [a]	.....	.....	6,500	.708	.79	387,000	B.
July [a]	.....	.....	6,000	.654	.75	369,000	B.
August [a]	.....	.....	5,400	.588	.68	332,000	B.
September [a]	.....	.....	5,400	.588	.66	321,000	B.
October [a]	.....	.....	5,400	.588	.68	332,000	B.
November [b]	6,000	5,940	5,990	.653	.73	356,000	B.
December	5,980	5,550	5,750	.626	.72	354,000	A.
The period	16,000	.....	6,570	.715	9.74	4,770,000	

[a] Discharges for March 1 to 14 and June to October have been estimated by comparison with the station at West's ranch.

[b] Mean for November 16 to 31 taken as mean for the month.

EAST FORK OF DESCHUTES RIVER AT CRESCENT,[a] OREG.

This station, which was established December 25, 1904, and abandoned March 31, 1908, was located at Crescent, in the SW. ¼ sec. 30, T. 24 S., R. 9 E.

The data obtained here are particularly valuable in connection with irrigation development. A large project involving the irrigation of Walker basin is proposed, the water supply for which will be obtained from this stream. The conditions at the station are not favorable for good results and those obtained are liable to considerable error.

Discharge measurements of East Fork of Deschutes River at Crescent, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
1907. April 8	I. E. Oakes	24	63	3.62	174
1908. October 2	J. Jacobs	.....	.....	2.20	35

Daily gage height, in feet, of East Fork of Deschutes River at Crescent, Oreg., for 1907 and 1908.

[Charles Graves, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[b]												
1	2.7	3.5	3.3	3.1	4.0	3.8	3.1	2.5	2.4	2.4	2.25	2.25
2	2.9	3.6	3.3	3.1	4.0	3.85	3.1	2.5	2.4	2.4	2.25	2.3
3	2.8	3.5	3.3	3.0	3.9	4.0	3.1	2.5	2.4	2.35	2.25	2.3
4	2.7	4.0	3.2	3.0	3.9	4.0	3.1	2.5	2.4	2.35	2.25	2.3
5	3.7	4.3	3.1	3.1	3.9	4.0	3.1	2.5	2.4	2.35	2.25	2.3
6	3.1	5.2	3.1	2.9	3.5	4.0	3.0	2.5	2.4	2.35	2.25	2.3
7	2.9	4.9	3.2	3.2	3.5	4.0	3.0	2.5	2.4	2.35	2.25	2.3
8	3.0	4.8	3.2	3.7	3.7	3.9	3.2	2.5	2.4	2.35	2.25	2.3
9	2.9	4.5	3.1	3.7	3.7	3.7	3.1	2.6	2.4	2.3	2.25	2.3
10	2.9	3.8	3.1	3.75	3.8	3.5	3.0	2.6	2.4	2.3	2.25	2.3
11	2.9	4.2	3.1	3.7	3.9	3.7	2.9	2.55	2.4	2.3	2.25	2.35
12	2.9	4.0	3.1	3.7	4.0	3.8	2.9	2.55	2.4	2.3	2.25	2.45
13	3.0	3.7	3.1	3.7	3.9	3.7	2.9	2.6	2.4	2.3	2.25	2.7
14	3.0	3.5	3.0	3.75	3.8	3.6	2.9	2.6	2.4	2.3	2.25	2.8
15	2.9	3.4	3.0	3.8	3.75	3.6	2.9	2.55	2.4	2.3	2.25	2.9
16	2.85	3.4	3.0	3.9	3.8	3.3	2.8	2.5	2.4	2.3	2.25	2.8
17	2.9	3.4	3.0	3.9	3.9	3.0	2.8	2.5	2.4	2.25	2.3	2.3
18	3.0	3.4	3.1	3.95	3.9	3.2	2.8	2.5	2.4	2.25	2.35	2.3
19	3.0	3.4	3.3	4.0	4.05	3.3	2.7	2.45	2.4	2.25	2.3	2.3
20	3.0	3.4	3.7	4.1	4.2	3.3	2.7	2.4	2.4	2.25	2.3	2.3
21	3.0	3.35	3.4	4.1	4.2	3.3	2.7	2.4	2.4	2.25	2.3	2.8
22	3.0	3.4	3.1	4.1	4.1	3.3	2.7	2.4	2.4	2.25	2.3	2.95
23	3.0	3.4	3.1	4.1	4.0	3.3	2.7	2.4	2.4	2.25	2.3	3.6
24	2.9	3.4	3.1	4.2	3.9	3.2	2.7	2.4	2.4	2.25	2.3	3.6
25	2.9	3.6	3.0	4.2	3.8	3.2	2.6	2.45	2.4	2.25	2.55	3.3
26	3.0	3.4	3.0	4.2	3.7	3.2	2.6	2.4	2.4	2.25	2.4	3.4
27	3.0	3.3	3.0	4.2	3.7	3.2	2.6	2.4	2.4	2.25	2.3	3.5
28	3.05	3.2	3.0	4.1	3.7	3.2	2.6	2.4	2.4	2.25	2.3	3.3
29	3.1	.....	3.0	4.1	3.7	3.2	2.6	2.4	2.4	2.25	2.3	3.0
30	3.15	.....	3.0	4.1	3.7	3.2	2.6	2.4	2.4	2.25	2.3	3.0
31	3.3	.....	3.1	.....	3.8	.....	2.5	2.4	.....	2.25	.....	2.9

[a] Formerly known as Odell post-office.

[b] River partly frozen over January 10 to about February 5; the ice reached a maximum thickness of about 8 inches.

Daily gage height, in feet, of East Fork of Deschutes River at Crescent, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1908.				1908.				1908.			
1	2.9	2.55	2.5	11	2.6	2.8	2.5	21	2.45	2.8	2.5
2	2.9	2.7	2.4	12	2.6	2.7	2.5	22	2.65	2.8	2.7
3	2.8	2.85	2.4	13	2.6	2.7	2.65	23	2.8	2.8	2.7
4	2.7	2.8	2.3	14	2.6	2.8	3.0	24	2.7	2.8	2.8
5	2.6	2.8	2.3	15	2.6	3.1	3.0	25	2.55	2.8	2.8
6	2.6	2.8	2.3	16	2.6	2.9	3.1	26	2.55	2.8	2.8
7	2.6	2.8	2.85	17	2.5	2.8	3.0	27	2.45	2.8	2.7
8	2.6	2.8	2.85	18	2.5	2.7	2.9	28	2.45	2.7	2.6
9	2.6	2.8	2.4	19	2.5	2.8	2.7	29	2.8	2.6	2.5
10	2.6	2.8	2.7	20	2.5	2.8	2.5	30	2.68	.....	2.5
								31	2.7	.....	2.6

Rating table for East Fork of Deschutes River at Crescent, Oreg., for 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	30	3.00	90	3.80	188	4.60	305
2.30	36	3.10	100	3.90	202	4.70	320
2.40	42	3.20	110	4.00	216	4.80	335
2.50	49	3.30	121	4.10	230	4.90	350
2.60	56	3.40	133	4.20	245	5.00	365
2.70	64	3.50	146	4.30	260	5.10	380
2.80	72	3.60	160	4.40	275	5.20	395
2.90	81	3.70	174	4.50	290		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1906–1908, and the form of previous curves, and is fairly well defined between gage heights 2.7 feet and 3.7 feet.

Monthly discharge of East Fork of Deschutes River at Crescent, Oreg., for 1907–8.

[Drainage area, 196 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	174	64	89.7	0.458	0.53	5,520	C.
February	395	110	183	.934	.97	10,200	C.
March	174	90	104	.531	.61	6,400	B.
April	245	81	184	.939	1.05	10,900	B.
May	245	146	195	.995	1.15	12,000	C.
June	216	90	151	.770	.86	8,980	B.
July	110	49	76.5	.390	.45	4,700	B.
August	56	42	47.5	.242	.28	2,920	C.
September	42	42	42.0	.214	.24	2,500	C.
October	42	33	35.5	.181	.21	2,180	C.
November	52	33	35.2	.180	.20	2,090	C.
December	160	33	68.9	.352	.41	4,240	C.
The year	395	33	101	.516	6.96	72,600	
1908.							
January	81	46	58.1	.296	.34	3,570	C.
February	100	52	70.8	.361	.39	4,070	C.
March	100	36	60.9	.311	.36	3,740	C.

WEST FORK OF DESCHUTES RIVER NEAR LAVA, OREG.

A station was established February 26, 1905, on the stream locally known as Big River, 1½ miles west of Lava post-office and about the same distance above the mouth of the stream, in the NE. ¼ sec. 24, T. 20 S., R. 10 E. As it was impossible to obtain continuous observations of gage height, the station was abandoned March 31, 1907.

The station furnishes data of considerable economic value, as the waters of the stream will be largely used for irrigation and some exceptional storage sites are found on its headwaters. The flow of the West Fork can approximately be estimated by deducting the flow of the Deschutes (Little River) at Lava and about 300 second-feet for Spring River, from the flow obtained on Deschutes River at West's ranch. (See description of Deschutes River at West's ranch.)

Discharge measurements of West Fork of Deschutes River near Lava, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 9	I. E. Oakes	100	536	8.75	1,130
1908. March 27	H. D. McGlashan	101	500	8.46	1,010

Daily gage height, in feet, of West Fork of Deschutes River near Lava, Oreg., for 1907.

[David Hill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1					16		8.9		
2		8.1	8.3		17				
3					18				
4					19	8.6			
5			8.3		20				
6	8.1				21				
7					22				
8					23		8.5	8.4	
9		8.7	8.8	8.75	24				
10					25				
11					26	7.8			
12	8.0				27				
13					28				9.0
14				8.8	29				
15			8.1		30			8.1	
					31				

NOTE.—The river was frozen at the gage January 6 to 26. The ice reached a maximum thickness of 5 inches.

Rating table for West Fork of Deschutes River near Lava, Oreg., for 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.80	802	8.30	940	8.80	1,130
7.90	827	8.40	975	8.90	1,180
8.00	853	8.50	1,010	9.00	1,230
8.10	880	8.60	1,050		
8.20	910	8.70	1,090		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 6 discharge measurements made during 1906–1908 and is fairly well defined.

Monthly discharge of West Fork of Deschutes River near Lava, Oreg., for 1907.

[Drainage area, 360 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square Mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	1,050	802	896	2.49	2.87	55,100	B.
February	1,180	880	1,040	2.89	3.01	57,800	B.
March	1,130	880	958	2.66	3.07	58,900	B.
April	1,230	1,110	1,160	3.22	3.59	69,000	B.

NOTE.—Owing to the steady flow of the stream, the mean discharge for the days in each month when the gage was read has been taken as the mean for the month.

TUMALO CREEK NEAR LAIDLAW AND BEND, OREG.

This station, which was established May 15, 1906, has been maintained at two different points on the stream. The regular Tumalo station was originally located one-half mile above the head-gate of the Columbia Southern canal in sec. 2, T. 18 S., R. 10 E. At this point records were obtained during the irrigating season only, observations being taken by the patrolman on the Columbia Southern canal, who lived at the head-gate. During the winter months, however, no patrolman was kept at this point, and records were obtained at a bridge on the Bend-Sisters road about 6 miles downstream from the regular Tumalo station. At the lower point approximate results have been obtained during the winter months, although the conditions do not favor accuracy. The gage datum has been changed, as the bridge was removed some time during the winter of 1907–8, and the gage was moved with it without making record of the date of change.

The records from the regular station at Tumalo during the irrigating season are fairly reliable, as the conditions are favorable for good results, and observations were carefully and conscientiously kept. The records of gage height are furnished without cost to the Survey by the Columbia Southern Irrigating Company. During the irrigating season of 1906–7 the station was located between the head-gate of the Columbia Southern canal and the head-gate of the Wimer ditch. The natural flow at this point is obtained by adding the diversion of Wimer canal to the flow in the stream. On April 1, 1908, the station was moved to a point 1½ miles above the intake of the Columbia Southern canal and about 300 feet above the intake of Wimer canal. (See the descriptions of stations on these canals.)

The data obtained on Tumalo Creek are valuable principally in connection with irrigation development. The Columbia Southern Irrigating Company selected about 27,000 acres of land for reclamation under the provisions of the Carey Act without having adequate information as to the water supply. The canal was hurriedly con-

structed and land was sold to the settlers. It was afterward found that the quantity of water was not sufficient without storage to supply more than one-third of the segregation. This has entailed a great amount of litigation and has been a great source of trouble between the State, the company, and the settlers.

Discharge measurements of Tumalo Creek near Laidlaw, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14 [a]	I. E. Oakes	37	44	1.80	120
April 19 [a]	W. P. Hardesty	36	44	1.80	118
May 3 [a]	do	36	48	1.90	142
1908.					
April 1 [a]	H. D. McGlashan	37	37	1.60	69
April 1 [b]	do	32	43	2.25	92
June 16 [b]	J. H. Lewis	.....	72	3.20	288
June 23 [b]	H. D. McGlashan	32	58	2.78	176
December 31 [b]	R. B. Post	31	35	2.12	74

[a] At station below intake of Wimer canal. [b] Above Wimer canal.

Daily gage height, in feet, of Tumalo Creek near Laidlaw, Oreg., for 1907 and 1908.

[G. W. Updike, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1907.								1908.							
1	.....	1.95	2.85	2.45	1.95	1.65	1.6	1	2.25	2.75	2.85	3.3	2.4	2.2	2.2
2	.....	1.95	2.85	2.45	1.8	1.6	1.6	2	2.25	2.7	2.8	3.5	2.35	2.2	2.2
3	.....	1.9	2.8	2.65	1.75	1.6	1.55	3	2.25	2.65	2.75	3.4	2.35	2.2	2.2
4	.....	1.9	2.65	2.5	1.7	1.6	1.55	4	2.27	2.6	2.75	3.35	2.3	2.2	2.2
5	.....	2.0	2.75	2.4	1.7	1.6	1.55	5	2.27	2.75	2.8	3.35	2.3	2.2	2.2
6	.....	2.05	2.65	2.4	1.65	1.65	1.55	6	2.2	2.85	3.0	3.3	2.25	2.2	2.2
7	.....	2.05	2.85	2.35	1.6	1.65	1.55	7	2.25	2.85	3.2	3.25	2.25	2.2	2.2
8	.....	2.15	1.9	2.45	1.75	1.65	1.55	8	2.25	2.75	3.3	3.5	2.25	2.2	2.2
9	.....	2.2	1.9	2.55	1.65	1.6	1.55	9	2.25	2.7	3.3	3.45	2.25	2.2	2.2
10	.....	2.2	2.4	2.55	1.55	1.6	1.55	10	2.35	2.75	3.4	3.3	2.25	2.2	2.2
11	.....	2.2	2.35	2.5	1.55	1.6	1.55	11	2.4	2.65	3.6	3.25	2.25	2.2	2.2
12	.....	2.1	2.3	2.5	1.65	1.6	1.55	12	2.4	2.65	3.55	3.35	2.25	2.2	2.2
13	.....	2.05	2.3	2.25	1.65	1.6	1.55	13	2.4	2.6	3.6	3.3	2.25	2.2	2.45
14	.....	2.25	2.1	2.15	1.6	1.6	1.55	14	2.4	2.6	3.65	3.35	2.25	2.2	2.8
15	.....	2.35	2.5	2.2	1.6	1.6	1.55	15	2.55	2.55	3.65	3.0	2.25	2.2	2.4
16	.....	2.45	2.0	2.2	1.6	1.6	1.65	16	2.55	2.5	3.2	3.1	2.25	2.2	2.4
17	.....	2.55	2.1	2.25	1.6	1.6	1.65	17	2.55	2.5	3.3	3.15	2.25	2.2	2.3
18	.....	2.65	2.3	2.0	1.55	1.6	1.6	18	2.55	2.5	3.25	3.1	2.25	2.2	2.3
19	1.8	2.45	2.55	2.25	1.55	1.55	1.55	19	2.9	2.5	3.0	3.0	2.25	2.2	2.3
20	1.8	2.35	2.5	2.25	1.55	1.55	1.55	20	2.85	2.45	3.0	3.0	2.25	2.2	2.25
21	1.8	2.3	2.3	2.25	1.55	1.55	1.55	21	2.8	2.55	2.9	3.1	2.25	2.2	2.25
22	1.85	2.2	2.1	2.1	1.55	1.55	1.55	22	2.75	2.55	2.85	2.9	2.25	2.2	2.25
23	1.9	2.2	2.1	2.0	1.55	1.55	1.55	23	2.7	2.65	2.8	2.85	2.25	2.2	2.25
24	1.9	2.2	2.3	2.0	1.7	1.6	1.55	24	2.65	2.65	3.2	2.8	2.15	2.2	2.25
25	1.9	2.3	2.35	2.0	1.65	1.6	1.55	25	2.6	2.75	3.35	2.8	2.15	2.2	2.25
26	1.9	2.4	2.5	2.0	1.65	1.6	1.55	26	2.6	2.7	3.1	2.7	2.15	2.2	2.25
27	1.9	2.3	2.6	1.9	1.65	1.6	1.6	27	2.6	2.75	3.1	2.6	2.2	2.2	2.25
28	1.9	2.5	2.5	1.85	1.65	1.6	1.55	28	2.6	2.8	3.05	2.4	2.25	2.2	2.3
29	1.85	2.6	2.5	1.8	1.6	1.6	1.6	29	2.65	2.85	3.2	2.45	2.2	2.2	2.3
30	1.85	2.7	2.55	1.95	1.6	1.6	1.55	30	2.7	2.85	3.15	2.75	2.2	2.2	2.4
31	.....	2.8	.....	2.0	1.6	.....	1.55	31	.....	2.85	.....	2.80	2.2	.....	2.3

Rating tables for Tumalo Creek near Laidlaw, Oreg.

1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	70	1.90	147	2.30	253	2.70	378
1.60	87	2.00	172	2.40	283	2.80	413
1.70	105	2.10	198	2.50	313	2.90	450
1.80	125	2.20	225	2.60	345		

1908.[b]

2.10	75	2.60	142	3.10	259	3.60	440
2.20	84	2.70	160	3.20	290	3.70	485
2.30	96	2.80	180	3.30	323		
2.40	110	2.90	203	3.40	360		
2.50	125	3.00	230	3.50	400		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1906 and 1907, and is well defined between gage heights 1.8 feet and 2.3 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1908, and is well defined below gage height 3.2 feet.

Monthly discharge of Tumalo Creek near Laidlaw, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.[a]					
April 19-30	147	125	139	3,310	B.
May	413	147	247	15,200	B.
June	432	147	291	17,300	B.
July	362	125	237	14,600	B.
August	160	78	94.1	5,790	B.
September	96	78	86.7	5,160	B.
October	96	78	80.6	4,960	B.
The period				66,300	
1908.					
April	203	84	127	7,560	A.
May	192	118	156	9,590	A.
June	462	170	285	17,000	A.
July	400	110	264	16,200	A.
August	110	80	90.1	5,540	A.
September	84	84	84.0	5,000	A.
October	180	84	94.6	5,820	A.
The period				66,700	

[a] Discharges for 1907 do not include the amount diverted by the Wimer Canal.

Discharge measurements of Tumalo Creek near Bend, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 15	I. E. Oakes	33	45	1.50	148
May 4	W. P. Hardesty	27	38	1.55	108
1908.					
April 1	H. D. McGlashan	34	36	1.30	46
June 23	do	35	43	1.37	62
October 24	R. B. Post	18	16	1.00	16

[a] Estimated.

Daily gage height, in feet, of Tumalo Creek near Bend, Oreg., for 1907 and 1908.

[William P. Downing, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.
1907.[a]							1907.[a]						
1	1.9	1.4	1.55	1.4	1.45	1.5	16	5.1	1.6	1.4	1.5	1.5	1.45
2	2.1	1.65	1.55	1.0	1.45	1.5	17	5.35	1.6	1.6	1.5	1.5	1.45
3	2.1	1.75	1.5	1.05	1.5	1.5	18	5.3	1.6	1.65	1.5	1.45	1.4
4	2.2	1.8	1.5	1.05	1.45	1.5	19	5.35	1.6	1.6	1.5	1.45	1.4
5	2.1	2.5	1.5	1.1	1.45	1.55	20	5.3	1.6	1.5	1.5	1.45	1.45
6	2.0	2.6	1.5	1.4	1.45	1.55	21	4.2	1.75	1.5	1.55	1.45	1.5
7	2.1	1.8	1.6	1.4	1.45	1.5	22	4.3	1.75	1.5	1.45	1.5	1.8
8	2.3	1.8	1.6	1.3	1.45	1.45	23	4.3	1.7	1.55	1.5	1.5	1.85
9	3.3	1.7	1.6	1.3	1.45	1.45	24	4.25	1.8	1.65	.....	1.5	1.75
10	3.2	1.6	1.55	1.4	1.45	1.5	25	4.2	1.8	1.6	.....	1.5	1.75
11	3.65	1.75	1.55	1.45	1.4	1.5	26	3.3	1.8	1.5	.....	1.5	1.7
12	3.8	1.7	1.5	1.4	1.45	1.45	27	3.35	1.7	1.4	.....	1.55	1.65
13	3.9	1.7	1.45	1.4	1.5	1.45	28	1.35	1.6	1.4	.....	1.55	1.6
14	3.85	1.6	1.45	1.4	1.5	1.45	29	1.3	.....	1.4	.....	1.55	1.6
15	4.65	1.6	1.4	1.5	1.5	1.45	30	1.3	.....	1.4	.....	1.5	1.6
							31	1.45	.....	1.4	.....	.....	1.6

Day.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.
1908.								1908.							
1	1.6	1.95	1.5	1.3	.....	1.4	1.5	16	1.5	1.5	1.8	.....	.....	1.4	1.5
2	1.6	[b]2.7	1.5	1.4	.....	1.4	1.45	17	1.5	1.5	1.8	.....	.....	1.4	[b]1.7
3	1.55	[b]3.5	1.55	1.4	.....	1.4	1.45	18	1.5	1.5	1.7	.....	.....	1.4	[b]2.3
4	1.55	1.9	1.6	1.4	.....	1.45	1.4	19	1.55	1.45	1.65	.....	.....	1.45	[b]2.7
5	1.5	1.5	1.7	1.4	.....	1.45	1.45	20	1.55	1.45	1.6	.....	.....	1.35	[b]3.0
6	1.5	1.5	1.6	1.35	.....	1.45	1.5	21	1.6	1.5	1.6	.....	.....	1.35	[b]3.3
7	1.5	1.45	1.5	1.4	.....	1.4	1.45	22	1.6	1.5	1.6	.....	.....	1.3	[b]3.5
8	1.5	1.45	1.5	1.3	.....	1.4	1.45	23	1.55	1.5	1.6	.....	.....	1.25	[b]2.2
9	1.55	1.5	1.45	1.35	.....	1.4	1.4	24	1.55	1.55	1.55	.....	.....	1.15	[b]2.0
10	1.5	1.55	1.45	1.6	.....	1.35	1.45	25	1.5	1.55	1.55	.....	1.0	1.2	[b]1.8
11	1.5	1.7	1.5	1.7	.....	1.35	1.45	26	1.6	1.5	1.5	.....	.9	1.25	1.7
12	1.5	1.75	1.5	1.7	.....	1.4	1.45	27	1.65	1.5	1.5	.....	.9	1.45	1.4
13	1.5	1.8	1.5	1.7	.....	1.35	1.5	28	1.7	1.45	1.5	.....	1.0	1.5	1.4
14	1.5	1.85	1.55	.....	.....	1.35	1.5	29	1.75	1.5	1.45	.....	1.0	1.5	1.4
15	1.5	1.9	1.75	.....	.....	1.4	1.5	30	1.8	.....	1.4	.....	1.0	1.5	1.4
								31	1.9	.....	1.4	.....	1.2	.....	1.4

[a] Rise in gage height from January 9 to 27 caused by ice jam below gage.
[b] Stream blocked with ice.

Rating tables for Tumalo Creek near Bend, Oreg.

OCTOBER 6, 1906, TO APRIL 23, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	5	1.10	74	1.90	242	2.70	472
.40	8	1.20	91	2.00	269	2.80	503
.50	12	1.30	109	2.10	296	2.90	534
.60	18	1.40	128	2.20	324	3.00	565
.70	26	1.50	148	2.30	353	3.20	628
.80	35	1.60	170	2.40	382	3.40	692
.90	45	1.70	193	2.50	412	3.60	756
1.00	58	1.80	216	2.60	442	3.80	820

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1906 and 1907, and is fairly well defined below gage height 1.5 feet.

Rating tables for Tumalo Creek near Bend, Oreg.—Continued.

NOVEMBER 1, 1907, TO DECEMBER 31, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	10	1.20	35	1.50	78	1.80	132
1.00	17	1.30	48	1.60	95	1.90	152
1.10	25	1.40	62	1.70	113	2.00	174

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908, and is well defined between gage heights 1.0 foot and 1.4 feet.

Monthly discharge of Tumalo Creek near Bend, Oreg., for 1906, 1907, and 1908.

Month.	Discharge in second-feet.			Run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.					
October 6–31	269	5	27.0	1,390	D.
November	820	118	242	14,400	C.
December	182	109	145	8,920	B.
1907.[a]					
January	353	109	235	14,400	D.
February	442	128	206	11,400	B.
March	182	128	151	9,280	B.
April 1–23	159	158	124	5,660	C.
November	86	62	74.5	4,430	C.
December	142	62	86.0	5,290	C.
1908.					
January	152	78	90.1	5,540	C.
February[b]	163	70	97.8	5,630	C.
March	132	62	88.5	5,440	B.
April 1–13	113	48	73.1	1,880	B.
October 25–31	35	10	17.6	244	C.
November	78	30	60.0	3,570	B.
December[c]	78	62	69.7	4,290	C.

[a] Discharge interpolated January 9 to 27.
[b] Discharge interpolated February 2 and 3 .
[c] Discharge interpolated December 17 to 26.

Total monthly discharge of Tumalo Creek near Laidlaw, Oreg., for 1907 and 1908.

[Drainage area, 90 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	353	109	235	2.61	3.01	14,400	D.
February	442	128	206	2.29	2.38	11,400	B.
March	182	128	151	1.68	1.94	9,280	B.
April	168	58	133	1.48	1.65	7,910	C.
May	458	170	279	3.10	3.57	17,200	B.
June	480	172	323	3.59	4.00	19,200	B.
July	400	157	272	3.02	3.48	16,700	B.
August	194	106	125	1.39	1.60	7,670	B.
September	124	103	112	1.24	1.38	6,700	B.
October	115	96	104	1.16	1.34	6,390	B.
November	86	62	74.5	.828	.92	4,430	C.
December	142	62	86.0	.956	1.10	5,290	C.
The year	480	58	175	1.95	26.37	127,000	

Total monthly discharge of Tumalo Creek near Laidlaw, Oreg., for 1907 and 1908—Con.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	152	78	90.1	1.00	1.15	5,540	C.
February	163	70	97.8	1.09	1.18	5,630	C.
March	132	62	88.5	.983	1.13	5,440	B.
April	203	84	127	1.41	1.57	7,560	A.
May	192	118	156	1.73	1.99	9,590	A.
June	462	170	285	3.17	3.54	17,000	A.
July	400	110	264	2.93	3.38	16,200	A.
August	110	80	90.1	1.00	1.15	5,540	A.
September	84	84	84.0	.933	1.04	5,000	A.
October	180	84	94.6	1.05	1.21	5,820	A.
November	78	30	60.0	.667	.74	3,570	D.
December	78	62	69.7	.774	.89	4,290	C.
The year	462	30	126	1.40	18.97	91,200	

NOTE.—Discharges for January 1 to April 18, 1907; November 1, 1907 to March 31, 1908, and November 1 to December 31 are for the station near Bend. For April 19 to October 31, 1907, they are the sums of the discharges at the Laidlaw station and of the Wimer canal; for April to October, 1908, they are for the Laidlaw station above the Wimer canal. The values for March, April, and November, and possibly for the winter months, may not correctly represent the total flow of the creek, as there may have been some water diverted past the lower station in both the Wimer and Columbia Southern canals. The minima of both 1907 and 1908 are liable to error on this account, but the effect on the yearly means should not be very great.

LEWIS CREEK NEAR LAIDLAW, OREG.

This station was established April 2, 1908, at the mouth of the creek, which has its source in a small lake and empties into Tumalo Creek 2 miles above the intake of the Columbia Southern canal.

The data will be valuable in the study of possible storage development in the basin of Tumalo Creek.

Discharge measurements of Lewis Creek near Laidlaw, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 2	H. D. McGlashan	5	1.5	0.69	1.3
June 24	do	4.3	1.2	.64	1.4

Daily gage height, in feet, of Lewis Creek near Laidlaw, Oreg., for 1908.

[G. W. Updike, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1							0.6	16				0.6			
2	0.69					0.6		17					0.6		
3				0.6				18							
4								19							0.65
5			0.65		0.6			20							
6								21	1.01					0.6	
7			.75			.6		22		0.85					
8		0.91						23							
9								24			0.65		.6		
10								25							
11				.6				26				.6			
12					.6		.6	27				.6			
13				.6				28	.9					.6	
14						.6		29		.9					
15		.9						30	.92						.6
								31					.6		

SQUAW CREEK NEAR SISTERS, OREG.

This station, which was established June 15, 1906, is located above all present ditches with the exception of McAllister ditch, which was not completed at the time the station was established. There is a waste-way from McAllister ditch just below the station, and the flow in the canal should be added to that in the creek to determine the natural flow at this point. (See list of miscellaneous measurements in the Deschutes drainage basin for gagings of McAllisters ditch.)

The waters of Squaw Creek are extensively used for irrigation in small ditches, and segregation of large areas of land have been made for reclamation under the provisions of the Carey Act to be irrigated from this creek.

The data at this station are not very reliable. A short distance below the station is a diversion dam, consisting of logs, brush, stone, etc., which either goes out entirely or is altered during freshets, so that the relation between gage height and discharge at the station is not stable. The gage washed out on January 12, 1909. The stream usually freezes during a portion of the winter and during such period records are unreliable.

Discharge measurements of Squaw Creek near Sisters, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
April 11 [a]	I. E. Oakes	30	34	2.02	117
1908.					
March 30 [a]	H. D. McGlasham	27	39	2.79	76
June 25 [b]	do	31	57	4.06	157
October 23 [a]	R. B. Post	31	26	3.40	63

[a] Measured by wading. [b] Measured at foot log.

Daily gage height, in feet, of Squaw Creek near Sisters, Oreg., for 1907 and 1908.

[Samuel Wiehl, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	1.15	1.45	2.0	1.8	2.05	4.3	4.1	4.0	3.3	3.1	3.15	3.1
2	1.2	1.4	1.9	1.8	2.1	4.25	4.15	4.0	3.3	3.1	3.1	3.05
3	1.4	1.45	1.9	1.8	[b] 2.5	4.25	4.4	3.9	3.3	3.15	3.1	3.05
4	1.5	4.5	1.85	1.8	2.5	4.2	4.2	3.85	3.4	3.2	3.1	3.2
5	1.4	4.4	1.85	1.8	2.5	4.1	4.0	3.85	3.55	3.2	3.05	3.1
6	1.3	4.0	1.9	1.85	2.7	4.05	4.0	3.9	3.5	3.25	3.05	3.1
7	1.3	3.2	1.9	1.9	2.8	3.9	4.05	3.8	3.45	3.2	3.05	3.2
8	1.3	2.3	1.9	1.95	2.9	3.9	4.15	3.8	3.4	3.2	3.1	3.1
9	1.35	2.4	1.9	1.94	2.95	3.95	4.15	3.75	3.4	3.2	3.05	3.1
10	4.5	2.35	1.85	2.1	3.0	4.0	4.2	3.7	3.5	3.2	3.0	3.15
11	1.3	2.3	1.9	2.0	3.05	4.25	4.4	.....	3.65	3.2	3.0	3.15
12	1.5	2.2	1.9	2.0	3.05	4.0	4.3	3.5	3.6	3.2	3.0	3.2
13	1.5	2.2	1.85	2.0	3.0	3.85	4.3	.....	3.45	3.35	3.05	3.2
14	1.5	2.15	1.8	2.0	3.0	3.7	4.05	.....	3.3	3.2	3.05	3.4
15	4.0	2.1	1.8	2.05	3.35	3.65	3.95	.....	3.4	3.3	3.05	3.6
16	4.0	2.1	1.8	2.1	3.4	3.6	4.0	.....	3.4	3.2	3.1	3.7
17	3.95	2.1	1.8	2.1	3.4	3.6	3.95	.....	3.2	3.2	3.05	3.85
18	3.9	2.1	1.8	2.1	3.45	3.7	3.85	.....	3.15	3.2	3.35	3.85
19	3.9	2.1	1.8	2.1	3.6	4.0	3.85	.....	3.1	3.2	3.1	3.85
20	3.9	2.05	1.8	2.0	3.45	4.1	3.9	.....	3.1	3.2	3.05	3.15
21	3.95	2.05	1.8	2.0	3.45	4.1	4.05	.....	3.1	3.2	3.05	4.0
22	3.9	2.0	1.8	2.1	3.4	3.9	4.0	3.35	3.1	3.2	3.1	4.0
23	1.5	2.05	1.8	2.1	3.4	3.8	4.0	3.5	3.1	3.2	3.0	3.9
24	1.45	2.1	1.85	2.05	3.4	3.75	4.05	3.7	3.1	3.2	3.5	3.85
25	1.4	2.1	1.8	2.05	3.45	3.8	3.85	3.75	3.2	3.2	3.3	3.85
26	1.4	2.05	1.85	2.05	3.5	3.9	4.0	3.6	3.1	3.15	3.2	3.5
27	1.4	2.0	1.8	2.05	3.8	4.5	3.9	3.4	3.1	3.15	3.4	3.4
28	1.4	2.05	1.8	2.0	3.7	4.2	3.95	3.4	3.1	3.15	3.1	3.6
29	1.45	.....	1.8	2.0	4.2	4.1	3.95	3.3	3.1	3.35	3.1	3.8
30	1.5	.....	1.8	2.0	4.15	4.1	4.05	3.3	3.15	3.15	3.1	3.8
31	1.5	.....	1.8	.....	4.15	.....	3.95	3.35	.....	3.15	.....	3.8
1908.[c]												
1	3.2	4.0	2.9	2.7	3.05	3.05	4.15	4.1	3.55	3.4	3.5	3.4
2	3.2	4.0	2.9	2.7	3.05	3.0	4.2	4.05	3.55	3.35	3.5	3.4
3	3.2	4.0	3.0	2.75	3.05	2.95	4.3	4.05	3.55	3.4	3.5	3.35
4	3.15	3.6	3.0	3.0	.....	3.0	4.3	3.95	3.7	3.35	3.5	3.35
5	3.15	3.6	2.75	3.05	2.9	3.05	4.3	4.0	3.8	3.35	3.45	3.5
6	3.1	3.55	2.75	3.0	3.2	3.2	4.3	3.95	3.75	3.35	3.45	3.95
7	3.1	3.35	2.75	2.9	3.3	3.4	4.2	4.0	3.75	3.4	3.45	3.5
8	3.1	2.8	2.75	2.95	3.1	3.6	4.6	4.0	3.5	3.4	3.4	3.35
9	3.1	2.8	2.75	3.0	2.95	3.6	4.45	4.0	3.5	3.4	3.4	3.35
10	3.15	2.75	2.75	3.05	3.1	3.85	4.45	4.0	3.5	3.4	3.4	3.75
11	3.1	3.0	2.75	3.1	3.0	4.1	4.4	3.85	3.6	3.4	3.4	3.95
12	3.05	3.1	2.8	3.1	2.95	4.15	4.6	3.8	3.7	3.4	3.4	3.6
13	3.05	3.1	2.85	3.2	2.9	4.15	4.5	3.9	3.7	3.75	3.4	3.3
14	3.05	2.8	2.85	3.25	2.95	4.35	4.4	3.8	3.7	4.9	3.6	3.9
15	3.1	2.8	4.0	3.25	2.9	4.3	4.35	3.8	3.65	3.8	3.55	4.7
16	3.1	2.8	4.05	3.3	2.8	4.3	4.2	3.95	3.6	3.5	3.4	4.35
17	3.05	2.8	3.45	3.35	2.8	4.2	4.2	3.85	3.5	3.5	3.4	4.3
18	3.05	2.8	3.25	3.35	2.8	4.1	4.15	3.9	3.5	3.4	3.7	4.4
19	3.0	2.8	3.2	3.9	2.75	4.0	4.2	3.95	3.55	3.4	3.45	4.4
20	3.0	2.8	3.05	3.2	2.7	3.9	4.25	3.9	3.6	3.4	3.8	5.0
21	3.2	3.0	3.0	3.2	2.75	3.85	4.25	3.9	3.6	3.7	3.5	5.0
22	3.2	3.2	3.0	2.95	2.8	3.8	4.35	3.8	3.5	3.8	3.55	4.95
23	3.2	3.2	2.95	2.85	2.9	3.9	4.25	3.8	3.45	.....	3.5	4.8
24	3.2	2.75	2.95	2.85	3.05	3.9	4.2	3.7	3.4	3.4	3.5	4.8
25	3.2	2.75	2.9	2.75	3.2	4.1	4.15	3.6	3.35	3.4	3.5	4.75
26	3.2	2.75	3.1	2.7	3.0	4.2	4.05	3.6	3.35	3.4	3.6	4.0
27	3.2	2.7	2.85	2.7	3.0	4.0	4.0	3.6	3.35	3.4	3.9	4.0
28	3.05	2.7	2.85	2.65	3.1	3.95	4.0	3.6	3.4	3.4	3.95	4.1
29	3.1	2.7	2.9	2.7	3.25	4.0	4.05	3.5	3.4	3.45	4.0	4.9
30	3.1	.....	2.8	2.75	3.1	4.1	3.95	3.45	3.4	3.75	3.7	4.9
31	3.4	.....	2.8	.....	3.0	.....	4.05	3.5	.....	3.6	.....	4.9

[a] The creek was frozen January 10 to 24, November 18, 27, and December 14 to 19.

[b] Diversion dam of irrigating ditch backs up water.

[c] The creek was frozen wholly or in part on the following dates: January 31 to February 7, February 11 to 13, and 21 to 23, March 1 to 4, October 21 and 22, November 14, 15, and 26 to 30, December 5 to 7, 10 to 12, and 14 to 31. Diversion dam for irrigating ditch was put in in the early part of April; it was washed out April 19, and replaced during May and the first week in June.

Rating table for Squaw Creek near Sisters, Oreg., from June 10 to October 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	63	3.90	128	4.40	229	4.90	370
3.50	74	4.00	145	4.50	255	5.00	400
3.60	86	4.10	163	4.60	281		
3.70	98	4.20	183	4.70	310		
3.80	112	4.30	205	4.80	340		

NOTE.—The above table is applicable only for the period when the diversion dam remained intact. It is based on 2 discharge measurements made during 1908 and the form of the 1906 curve, and is fairly well defined below gage height 4.1 feet.

Monthly discharge of Squaw Creek near Sisters, Oreg., for 1908.

[Drainage area, 90 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
June 10-30	217	112	157	1.74	1.36	6,540	C.
July	281	136	197	2.19	2.52	12,100	C.
August	163	68	120	1.33	1.53	7,380	C.
September	112	58	80.3	.892	1.00	4,780	C.
October	370	58	78.2	.869	1.00	4,810	C.

CROOKED RIVER NEAR POST, OREG.

This station, which was established November 9, 1908, is located at Stewart Grade in a deep canyon 12 miles above Post and 6½ miles below the mouth of North Fork of Crooked River. It is at a proposed site for a dam that will impound a large amount of water for irrigation.

The project is under investigation by the United States Reclamation Service.

The following measurement was made by wading on November 9, 1908:

Width, 43 feet; area, 32 square feet; gage height, 0.15 feet; discharge, 53 second-feet.

Daily gage height, in feet, of Crooked River near Post, Oreg., for 1908.

[W. L. Harris, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.4	9		0.05	17	0.2	0.2	25	0.2	0.2
2		.4	10	0.1	.2	18	.2	.2	26	.25	.2
3		.25	11	.1	.2	19	.2	.2	27	.35	.2
4		.2	12	.1	.2	20	.2	.2	28	.6	.2
5		.2	13	.2	.2	21	.2	.2	29	.5	.2
6		.17	14	.2	.2	22	.2	.2	30	.5	.2
7		.18	15	.2	.2	23	.25	.2	31		.2
8		.05	16	.2	.2	24	.35	.2			

NOTE.—Anchor ice noted November 29. River frozen December 15 to 31, ice 14 inches thick.

CROOKED RIVER NEAR PRINEVILLE, OREG.

This station was established October 31, 1908, at Stearns's ranch, 5½ miles southeast of Prineville in sec. 36, T. 15 S., R. 15 E. Measurements are made from a plank walk built on the side of a flume which is carried across the river on a trestle.

The results obtained here will furnish data of value in connection with the general development of the waters of the Crooked River for irrigation by means of storage.

Discharge measurements of Crooked River near Prineville, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 2	R. B. Post	84	181	0.70	62
December 28[a]	do	85	160	.79	68

[a] Measured through ice.

Daily gage height, in feet, of Crooked River at Prineville, Oreg., for 1908.

[Harley Saunders, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.7	9	0.7	0.7	17	0.7		25	0.7	
2		.7	10	.7	.7	18	.7		26	.7	
3	0.7	.7	11	.7	.7	19	.7		27	.7	0.7
4	.7	.7	12	.7	.7	20	.7		28	.7	.8
5	.7	.7	13	.7		21	.7		29	.7	.8
6	.7	.7	14	.7		22	.7		30	.7	
7	.7	.7	15	.7		23	.7		31		
8	.7	.7	16	.7		24	.7				

NOTE.—River was frozen December 13 to 31.

OCHOCO CREEK AND ELLIOTT DITCH NEAR PRINEVILLE, OREG.

The station on Ochoco Creek was established October 29, 1908, at Elliott's ranch, 6 miles east of Prineville, in the NE ¼ sec. 5, T. 15 S., R. 17 E., on the dam site for a reservoir proposed in connection with the development of the Ochoco irrigation project by the United States Reclamation Service. Elliott's ditch diverts water from the left bank of Ochoco Creek about 1,000 feet above the gaging station. A station is also maintained on the ditch in order to determine the natural flow of the creek at this point.

The following measurement was made on Ochoco Creek, December 27, 1908:

Width, 12 feet; area, 7 square feet; gage height, 0.10 feet; discharge, 5.5 second-feet.

Daily gage height, in feet, of Ochoco Creek near Prineville, Oreg., for 1908.

[Geo. H. Perkins, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.3	9	0.2	0.5	17	0.5	0.2	25	0.5	0.1
2		.2	10	.2	.5	18	.5	.2	26	.5	.1
3		.3	11	.2	.5	19	.2	.2	27	.5	.5
4		.3	12	.2	.5	20	.2		28	.5	.5
5		.2	13	.2	.2	21	.2		29	.2	.5
6		.5	14	.2	.2	22	.5		30	.2	.5
7		.5	15	.1	.2	23	.2		31		.5
8		.5	16	.5	.3	24	.2				

NOTE.—Water was standing in pools November 4 to 8; creek frozen over December 20, and partly frozen December 21 to 30.

The following measurement was made on Elliott ditch, November 3, 1908:

Width, 6.3 feet, area of section 3.5 square feet, gage height 2.32 feet, discharge 2.9 second-feet.

From November 4 to 8, gage height 1.3 feet; November 9 to December 31 the ditch was dry.

METOLIUS RIVER NEAR SISTERS, OREG.

This station was established October 31, 1908, at Riggs's ranch, 7 miles above the mouth of the stream and 26 miles northwest of Sisters, in sec. 28, T. 11 S., R. 11 E.

The results obtained here will be particularly valuable for use in connection with water-power development and in making a general study of run-off conditions in the Deschutes River system. The stream throughout its course runs in a deep canyon and is entirely spring fed. The flow is well maintained throughout the year, no doubt because of the very porous nature of the soil composing the area. The headwaters are quite heavily forested.

The following measurement was made October 22, 1908:

Width, 102 feet; area, 326 square feet; gage height, 0.60 foot; discharge, 1,490 second-feet.

Daily gage height, in feet, of Metolius River near Sisters, Oreg., for 1908.

[D. N. Riggs, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		0.7	0.6	16		0.6	0.5
2		.6	.6	17		.6	.5
3		.6	.6	18		.8	.5
4		.6	.6	19		.7	.5
5		.6	.6	20		.8	.5
6		.6	.6	21		.7	.6
7		.6	.6	22	0.6	.7	.6
8		.6	.6	23	.6	.7	.6
9		.6	.6	24	.6	.6	.6
10		.6	.6	25	.6	.6	.6
11		.6	.6	26	.6	.6	.6
12		.6	.5	27	.6	.6	.6
13		.6	.5	28	.6	.6	.7
14		.6	.5	29	.9	.6	.6
15		.6	.5	30	.9	.6	.6
				31	.7		.6

NOTE.—No ice reported.

CANALS AND DITCHES IN DESCHUTES RIVER BASIN.

CENTRAL OREGON AND PILOT BUTTE CANALS NEAR BEND, OREG.

These canals have a common head-gate where water is diverted from Deschutes River, 3 miles above the town of Bend. They are operated for the reclamation of a large area of land segregated under the provisions of the Carey Act by the Deschutes Irrigation and Power Company, by whom the gage-height records are furnished without cost to the Survey. The data obtained are valuable in a study of the hydrographic features of the Deschutes River system, in which the State of Oregon is deeply interested.

The station on the Central Oregon canal was established March 11, 1905; measurements are made from flumes. The maximum amount diverted into this canal since its construction was 248 second-feet, August 10 to 13, 1908.

The station on Pilot Butte canal was established March 6, 1905, one-half mile below the waste-way and 1 mile below the point where the water diverted from Deschutes River is divided into the two canals. The measurements are made in an earth section and small changes in the channel have operated to diminish the accuracy of the results over what would have been obtained under stable channel conditions. The maximum amount diverted since the construction of the canal is 284 second-feet on August 9 to 12, 1908.

Discharge measurements of Central Oregon canal near Bend, Oreg., for 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 4	I. E. Oakes	13	20	1.52	95
1908. April 4	H. D. McGlashan	13.3	19	1.20	65

Daily gage height, in feet, of Central Oregon canal near Bend, Oreg., for 1907.

[Dan R. Smith, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.06	1.42	1.37	1.53	1.56	1.90	1.40	2.35	1.70	1.75	1.12	1.75
2	1.00	1.55	1.37	1.53	1.56	1.90	1.12	2.36	1.60	1.50	1.75	1.75
3	1.00	.....	1.37	1.53	1.56	2.00	1.90	2.38	1.80	1.65	1.70	1.75
4	1.00	.....	1.37	1.56	1.56	1.98	2.18	2.38	1.85	1.20	1.75	1.75
5	1.00	.....	1.37	1.60	1.56	1.95	2.20	2.40	1.85	1.70	1.75	1.63
6	1.00	.....	1.08	1.55	1.66	1.95	2.20	2.40	1.90	1.60	1.75	1.63
7	1.00	.....	.78	1.52	1.76	1.95	.....	2.40	1.82	1.80	1.75	1.60
8	.80	.....	.78	1.56	1.74	1.95	.....	2.30	1.75	.50	1.75	1.60
9	.40	.....	1.02	1.56	1.87	1.95	.....	2.20	1.70	.....	.88	1.60
10	.....	1.00	1.25	1.56	1.87	1.95	.....	2.20	1.75	1.55	1.70	1.60
11	.....	1.00	1.25	1.58	1.87	1.95	.....	2.15	1.60	.85	1.70	1.60
12	.....	.98	1.38	1.59	1.87	1.95	.....	2.15	1.50	1.80	1.65	1.60
13	.....	1.14	1.42	1.62	1.92	1.95	.....	2.12	1.80	1.80	1.66	1.60
14	.....	1.44	1.49	1.66	1.96	1.94	.....	2.00	1.82	1.70	1.68	1.52
15	.....	1.38	1.53	1.68	1.96	1.90	1.80	2.00	1.85	1.60	1.68	1.60

Daily gage height, in feet, of Central Oregon canal near Bend, Oreg., for 1907—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	.....	1.39	1.53	1.69	1.96	1.90	1.95	2.00	1.80	1.90	1.68	1.68
17	.....	1.42	1.53	1.70	1.94	1.88	2.15	2.00	1.80	1.70	1.60	.....
18	.....	1.40	1.54	1.70	1.96	1.85	2.22	2.00	1.85	.....	1.55	.....
19	.....	1.40	1.53	1.70	2.00	1.92	2.30	1.95	1.85	1.72	1.55	.....
20	.....	1.45	1.53	1.64	1.97	1.95	2.28	2.00	1.75	1.82	1.50	.....
21	.....	.65	1.53	1.54	1.99	2.02	2.25	2.00	1.50	1.75	1.45	.....
22	.....	.49	1.53	1.55	1.99	2.10	2.28	2.10	1.80	1.90	1.55	.....
23	.....	.40	1.53	1.55	1.95	2.12	2.30	2.05	1.78	1.90	1.50	.....
24	.....	.85	1.53	1.55	1.92	2.15	2.30	1.95	1.70	1.89	1.62	.85
25	.....	1.39	1.53	1.55	1.89	2.12	2.30	2.00	1.75	1.85	1.68	1.70
26	.....	1.48	1.53	1.55	1.80	2.15	2.30	1.98	1.75	1.85	1.60	1.70
27	.....	1.37	1.53	1.55	1.82	2.22	2.30	1.75	1.75	1.85	1.65	1.50
28	.....	1.37	1.53	1.55	1.81	2.28	2.30	1.82	1.72	1.85	1.65	1.50
29	0.80	.....	1.53	1.55	1.70	2.30	2.32	1.80	1.75	1.85	1.68	.....
30	1.06	.....	1.53	1.55	1.70	2.30	2.32	1.70	1.75	1.85	1.75	.....
31	1.20	.....	1.53	.....	1.78	.....	2.34	1.72	.....	1.85	.....	.....

NOTE.—The canal was dry on days when the gage height was not recorded.

Daily gage heights, in feet, of Central Oregon canal near Bend, Oreg., for 1908.

[F. P. Brown, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	.....	.....	.....	1.40	1.70	2.00	2.20	2.50	2.40	2.25	1.65	0.92
2	.....	.....	.....	1.40	1.80	2.00	2.28	2.50	2.40	2.25	1.65	.80
3	0.50	.....	.....	1.40	1.80	2.00	2.30	2.50	2.35	2.25	1.20	.80
4	1.15	.....	.....	1.30	1.80	2.02	2.40	2.50	2.35	2.20	.95	.80
5	1.50	.....	.....	1.20	1.80	2.05	2.40	2.50	2.35	2.15	.85	.80
6	1.60	0.69	.....	1.20	1.90	2.05	2.40	2.55	2.35	2.10	.80	.62
7	.80	1.38	.....	1.20	1.95	2.05	2.40	2.55	2.35	2.10	.80	.45
8	.....	1.38	1.55	1.10	1.95	2.10	2.40	2.55	2.35	2.10	.80	.45
9	1.30	1.58	1.58	1.10	1.95	2.10	2.42	2.60	2.35	2.10	.80	.60
10	.75	.79	1.75	1.14	1.95	2.10	2.45	2.65	2.35	2.10	.80	1.15
11	.75	.....	.....	1.17	1.95	2.08	2.50	2.65	2.35	2.10	.80	1.55
12	.75	.....	.....	1.16	1.95	2.10	2.50	2.65	2.35	2.10	.80	.95
13	.....	.....	.30	1.40	1.95	2.10	2.50	2.65	2.38	2.10	1.20	.65
14	.75	.....	.30	1.40	1.95	2.10	2.50	2.50	2.40	2.10	1.60	.65
15	1.00	.....	.30	1.40	1.95	2.10	2.50	2.45	2.40	2.10	1.60	.45
16	1.38	.....	.30	1.40	1.95	2.10	2.50	2.45	2.40	2.10	1.60	.45
17	1.48	.....	.30	1.40	1.95	2.10	2.50	2.45	2.38	2.00	1.60	.45
18	1.45	.....	.30	1.40	1.95	2.15	2.50	2.45	2.35	1.95	.80	.45
19	1.45	.....	.30	1.45	1.85	2.20	2.50	2.45	2.35	1.90	.80	.22
20	1.45	.....	.30	1.50	1.85	2.20	2.50	2.45	2.35	1.85	.80	.....
21	.....	1.55	.30	1.55	1.85	2.10	2.48	2.45	2.30	1.80	.80	.....
22	.....	.80	.30	1.60	1.88	2.10	2.50	2.45	2.25	1.70	.80	.28
23	.....	.....	.30	1.65	1.90	2.10	2.50	2.42	2.25	1.70	.80	1.00
24	.....	.....	.30	1.70	1.95	2.10	2.50	2.40	2.25	1.70	.80	1.38
25	.....	.....	.30	1.70	1.95	2.10	2.50	2.40	2.25	1.70	.80	1.50
26	.....	.....	.30	1.70	2.00	2.15	2.50	2.40	2.25	1.65	.80	1.58
27	.....	.....	.30	1.70	2.00	2.15	2.50	2.40	2.25	1.65	1.18	1.75
28	.....	.....	.85	1.70	2.00	2.18	2.50	2.40	2.25	1.65	1.55	1.85
29	.....	.....	1.40	1.70	2.00	2.20	2.50	2.40	2.25	1.65	1.30	1.68
30	.....	.....	1.40	1.70	2.00	2.20	2.50	2.40	2.25	1.65	1.05	.95
31	.....	.....	1.40	.....	2.00	.....	2.50	2.40	.....	1.65	.....	.70

NOTE.—The canal was dry on days when the gage height was not recorded.

Rating table for Central Oregon canal near Bend, Oreg., for 1906, 1907, and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	0	0.70	28	1.40	84	2.10	166
0.10	2	0.80	34	1.50	94	2.20	180
0.20	5	0.90	41	1.60	105	2.30	194
0.30	8	1.00	48	1.70	116	2.40	209
0.40	12	1.10	56	1.80	128	2.50	224
0.50	17	1.20	65	1.90	140	2.60	240
0.60	22	1.30	74	2.00	153	2.70	256

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 14 discharge measurements made during 1905–1908, and well-defined below gage height 2.0 feet.

Monthly discharge of Central Oregon canal near Bend, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	65	0	17.4	1,070	B.
February	100	0	50.5	2,800	B.
March	98	33	84.7	5,210	B.
April	116	96	104	6,190	B.
May	153	101	131	8,060	A.
June	194	134	155	9,220	A.
July	200	0	128	7,870	A.
August	209	116	165	10,100	A.
September	140	94	123	7,320	A.
October	140	0	108	6,580	B.
November	122	40	107	6,370	B.
December	122	0	71.4	4,390	B.
The year	209	0	104	75,200	
1908.					
January	105	0	32.2	1,980	B.
February	103	0	15.9	915	B.
March	122	0	23.7	1,460	B.
April	116	56	88.0	5,240	B.
May	153	116	142	8,730	A.
June	180	153	167	9,940	A.
July	224	180	217	13,300	A.
August	248	209	222	13,600	A.
September	209	187	199	11,800	A.
October	187	110	147	9,040	B.
November	110	34	56.2	3,340	B.
December	134	0	43.6	2,680	B.
The year	248	0	113	82,000	

Discharge measurements of Pilot Butte canal near Bend, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907. April 4	I. E. Oakes	34	53	2.10	65
1908. April 4[a]	H. D. McGlashan	38	57	2.10	67

[a] Made by wading.

Daily gage height, in feet, of Pilot Butte canal near Bend, Oreg., for 1907 and 1908.

[Dan R. Smith and F. P. Brown, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.4	.....	1.86	1.86	2.30	2.35	1.60	2.70	2.30	2.35	1.52	0.15
2	1.4	.....	1.86	1.86	2.30	2.70	1.60	2.70	2.40	2.20	2.55	.15
3	1.4	.....	1.86	1.98	2.30	2.70	2.70	2.70	2.40	2.32	2.55	.15
4	1.4	.....	1.86	2.10	2.30	2.70	2.68	2.70	2.40	1.40	2.55	.15
5	1.4	.....	1.86	2.10	2.35	2.70	2.68	2.70	2.40	2.40	2.40	.15
6	1.4	.....	1.86	2.10	2.40	2.70	2.70	2.70	2.40	1.98	2.40	.15
7	1.4	.....	1.86	2.10	2.40	2.56	.....	2.70	2.40	2.42	.....	.....
8	1.29	.....	1.86	2.10	2.40	2.42	.....	2.70	2.35	.40	2.40	1.20
9	.....	.....	1.86	2.10	2.40	2.51	.....	2.70	2.30	1.40	1.20	.....
10	.....	1.40	1.86	2.10	2.40	2.62	.....	2.70	2.30	1.85	2.40	.15
11	.....	1.66	1.86	2.10	2.40	2.62	2.20	2.70	2.20	2.25	2.40	.15
12	.....	1.86	1.86	2.10	2.40	2.62	2.00	2.70	2.15	2.30	2.40	.15
13	.....	1.88	1.86	2.10	2.40	2.62	1.90	2.70	2.40	2.40	.....	.15
14	.....	1.88	1.86	2.10	2.40	2.62	2.20	2.70	2.60	2.30	.....	1.22
15	.....	1.88	1.86	2.10	2.40	2.62	2.45	2.70	2.40	2.30	.....	2.70
16	.....	1.88	1.86	2.10	2.40	2.62	2.58	2.70	2.40	2.55	2.40	1.15
17	.....	1.90	1.86	2.10	2.38	2.62	2.72	2.69	2.40	2.30	2.40	.....
18	.....	1.88	1.86	2.10	2.40	2.62	2.70	2.32	2.45	2.10	2.40	.....
19	.....	1.90	1.86	2.10	2.50	2.61	2.70	2.55	2.45	2.10	2.40	.....
20	.....	1.91	1.86	2.10	2.48	2.61	2.70	2.55	2.45	2.48	.05	1.00
21	.....	1.90	1.86	2.10	2.49	2.65	2.70	2.55	2.18	2.40	.15	2.20
22	.....	1.95	1.86	2.15	2.49	2.70	2.70	2.60	2.40	2.60	.15	2.20
23	.....	2.00	1.86	2.25	2.48	2.70	2.70	2.60	2.40	2.60	2.15	2.20
24	.....	1.85	1.86	2.30	2.45	2.70	2.70	2.50	2.40	2.60	2.30	2.20
25	.....	1.78	1.86	2.30	2.46	2.70	2.70	2.55	2.35	2.55	2.30	2.20
26	.....	1.86	1.86	2.30	2.39	2.69	2.70	2.55	2.45	2.55	2.25	2.20
27	.....	1.86	1.86	2.30	2.40	2.69	2.70	2.65	2.45	2.55	.31	2.20
28	.....	1.86	1.86	2.30	2.38	2.69	2.70	2.50	2.40	2.55	2.25	.....
29	.....	.....	1.86	2.30	2.30	2.70	2.70	2.45	2.42	2.55	.....	.....
30	.....	.....	1.86	2.30	2.30	2.70	2.70	2.45	2.38	2.55	.08	.....
31	.....	.....	1.86	.....	2.38	.....	2.70	2.45	.....	2.55	.....	.....
1908.												
1	.....	.....	2.20	2.10	2.50	2.50	2.80	2.90	2.80	2.55	2.40	1.25
2	.....	.....	2.20	2.10	2.50	2.50	2.80	2.90	[a] 2.8	2.55	2.40	1.25
3	.80	.....	2.20	2.10	2.50	2.50	2.80	2.90	2.80	2.55	2.40	1.25
4	1.90	.....	2.20	2.15	2.50	2.50	2.80	2.90	2.80	2.55	2.40	1.25
5	2.00	.75	2.10	2.20	2.50	2.60	2.80	2.95	2.80	2.55	.....	1.25
6	2.05	2.00	.....	2.20	2.50	2.60	2.80	2.95	2.80	2.55	.....	1.25
7	1.40	2.00	.....	2.20	2.50	2.60	2.85	2.95	2.65	2.55	1.15	1.62
8	1.50	2.00	2.10	2.20	2.50	2.60	2.90	2.95	2.65	2.55	1.28	2.00
9	1.50	1.00	2.20	2.20	1.25	2.60	2.90	2.98	2.50	2.55	1.25	1.50
10	1.50	.....	2.20	2.20	2.50	2.60	2.95	2.98	2.60	2.52	1.25	1.50
11	2.10	.....	2.20	2.20	2.50	2.55	2.95	2.98	2.60	2.50	1.25	1.50
12	1.50	.....	2.10	2.25	2.50	2.60	2.95	2.98	2.60	2.50	1.25	2.05
13	2.10	.....	2.10	2.30	2.50	2.60	2.95	2.90	2.60	2.50	1.25	1.85
14	1.50	.....	2.10	2.35	2.50	2.60	2.95	2.85	2.60	2.50	1.28	1.65
15	1.50	.....	2.10	2.40	2.50	2.60	2.95	2.85	2.60	2.50	1.78	1.65
16	1.50	.90	2.10	2.40	2.50	2.60	2.95	2.88	2.60	2.50	1.25	1.65
17	1.30	2.00	2.10	2.40	2.50	2.60	2.95	2.90	2.60	2.50	1.25	1.30
18	1.65	2.00	2.10	2.40	2.50	2.62	2.95	2.90	2.60	2.50	2.00	.....
19	2.00	2.00	2.00	2.40	1.25	2.65	2.95	2.95	2.60	2.50	1.25	.....
20	2.00	.....	2.00	2.40	2.25	2.65	2.95	2.95	2.60	2.50	1.25	.....
21	.....	.....	2.00	2.40	2.50	2.70	2.92	2.95	2.60	2.40	1.80	.....
22	.....	.....	2.00	2.40	2.50	2.70	2.95	2.95	2.60	2.40	1.80	.....
23	.....	.....	2.05	2.40	2.50	2.70	2.95	2.92	2.60	2.35	1.25	.....
24	.....	.....	2.10	2.40	2.50	2.70	2.95	2.90	2.60	2.30	1.25	.....
25	.90	2.15	2.10	2.40	.....	2.72	2.95	2.90	2.60	2.30	1.25	.....
26	1.90	2.20	1.05	2.40	2.50	2.75	2.95	2.90	2.60	2.40	1.25	2.05
27	1.00	2.20	1.10	2.40	2.50	2.75	2.95	2.90	2.60	2.40	1.25	1.02
28	.....	2.20	2.15	2.35	2.50	2.75	2.95	2.90	2.60	2.40	2.25	.....
29	.....	2.20	2.10	2.38	2.50	2.75	2.95	2.85	2.55	2.40	2.25	.....
30	.....	.....	2.10	2.50	2.50	2.75	2.95	2.80	2.55	2.40	1.62	.....
31	.....	.....	2.10	.....	2.50	.....	2.90	2.80	.....	2.40	.....	.....

[a] For one-half day.

NOTE.—The canal was dry on days when the gage height was not recorded.

Rating table for Pilot Butte canal near Bend, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	1.5	1.30	9.1	1.90	42	2.50	145
.80	2.0	1.40	12.0	2.00	53	2.60	172
.90	3.0	1.50	16	2.10	66	2.70	201
1.00	4.0	1.60	20	2.20	80	2.80	230
1.10	5.5	1.70	26	2.30	99	2.90	260
1.20	7.2	1.80	34	2.40	121	3.00	290

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during 1906–1908, and is fairly well defined between gage heights 1.8 feet and 2.3 feet.

Monthly discharge of Pilot Butte canal near Bend, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet			Run-off, total in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	12	0	3.00	184	C.
February	53	0	26.1	1,450	C.
March	39	39	39.0	2,400	C.
April	99	39	72.4	4,310	B.
May	145	99	120	7,380	B.
June	201	110	183	10,900	C.
July	207	0	142	8,730	C.
August	201	103	178	10,900	C.
September	172	73	117	6,960	B.
October	172	0	111	6,820	B.
November	158	0	72.0	4,280	C.
December	99	0	22.1	1,360	C.
The year	207	0	90.5	65,700	
1908.					
January	66	0	19.4	1,190	C.
February	80	0	24.8	1,430	C.
March	80	0	59.3	3,650	C.
April	145	66	102	6,070	B.
May	145	0	130	7,990	B.
June	216	145	181	10,800	C.
July	275	230	284	16,200	C.
August	284	230	264	16,200	C.
September	230	115	179	10,700	B.
October	158	99	139	8,550	B.
November	121	0	33.3	1,980	C.
December	60	0	13.3	818	C.
The year	284	0	117	85,600	

WIMER CANAL NEAR LAIDLAW, OREG.

This canal diverts water from Tumalo Creek about three-fourths of a mile above the head-gate of the Columbia Southern canal. The station was established June 16, 1906, just below the head-gate of the canal and above the wasteway. It is maintained during the irrigating season only. The quantities shown during 1906–7 represent the amount diverted from the river. A part of this was returned through the wasteway which enters Tumalo Creek above the head-gate of the Columbia Southern canal. On April 1, 1908, the station was moved to a point below the wasteway and the records for this year show the net amount diverted for irrigation. To obtain the natural flow of the stream at this point for the years

1906 and 1907, the quantity diverted should be added to the flow in the creek. During 1908 the station on the creek was moved to a point above the intake of the Wimer canal, and the records there obtained represent the natural flow of the stream. The records of gage height are furnished without cost to the United States Geological Survey by the Columbia Southern Irrigating Company.

Discharge measurements of Wimer canal near Laidlaw, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14 [a]	I. E. Oakes	5.6	7.9	0.90	22
April 19 [a]	W. P. Hardesty	5.5	5.8	.90	17
May 3 [a]	do	5.5	6.8	.90	23
1808.					
April 1 [a]	H. D. McGlashan	10	8.2	.95	24
June 16 [b]	J. H. Lewis	.....	5	1.30	18
June 23 [b]	H. D. McGlashan	4	2.6	.65	6
Do. [b]	do	4	3.1	.78	8.3
Do. [b]	do	4	4.8	1.20	19
Do. [b]	do	4	5.6	1.40	24
June 24 [b]	do	4	5.9	1.48	26

[a] At intake. [b] Below wasteway.

Daily gage height, in feet, of Wimer canal near Laidlaw, Oreg., for 1907 and 1908.

[G. W. Updike, observer.]

Day.	1907.							1908.						
	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	0.95	1.8	1.35	1.35	1.0	1.0	0.95	1.05	1.15	1.6	1.6	1.3	1.3
2	.....	.95	1.75	1.35	1.25	.95	1.1	.95	1.05	1.15	1.6	1.6	1.3	1.3
3	.....	.9	1.75	1.45	1.25	.95	1.1	.95	1.05	1.15	1.6	1.6	1.3	1.3
4	.....	.9	1.6	1.35	1.25	1.1	1.05	.97	1.05	1.25	1.6	1.6	1.3	1.3
5	.....	.95	1.7	1.3	1.25	1.1	1.05	.97	1.05	1.25	1.6	1.6	1.3	1.3
6	.....	1.0	1.6	1.3	1.3	1.1	1.05	.9	1.05	1.25	1.6	1.6	1.1	1.3
7	.....	1.05	1.3	1.3	1.3	1.1	1.1	.9	1.05	1.25	1.6	1.6	1.1	1.3
8	.....	1.15	1.0	1.35	1.35	1.1	1.1	.9	1.05	1.30	1.6	1.6	1.3	1.3
9	.....	1.2	1.0	1.5	1.25	1.05	1.1	.9	1.05	1.30	1.6	1.6	1.3	1.3
10	.....	1.2	1.4	1.5	1.25	1.05	1.1	1.0	1.05	1.30	1.6	1.6	1.3	1.3
11	.....	1.2	1.3	1.45	1.25	1.05	1.1	1.0	1.05	1.30	1.6	1.6	1.3	1.3
12	.....	1.1	.9	1.45	1.2	1.05	1.1	1.0	1.05	1.30	1.6	1.6	1.3	1.3
13	.....	1.05	.9	1.35	1.2	1.05	1.1	1.0	1.05	1.30	1.6	1.6	1.3	1.3
14	.....	1.25	.7	1.3	1.2	1.05	1.1	1.0	1.05	1.35	1.45	1.6	1.3	1.1
15	.....	1.35	.65	1.3	1.2	1.05	1.1	1.05	1.05	1.35	1.45	1.6	1.3	1.1
16	.....	1.45	.9	1.3	1.15	1.05	(a)	1.05	1.0	1.35	1.45	1.6	1.3	1.1
17	.....	1.55	1.0	1.3	1.3	1.05	(a)	1.05	1.0	1.4	1.45	1.6	1.3	1.1
18	.....	1.65	1.5	1.2	1.25	1.05	.8	1.05	1.0	1.4	1.45	1.6	1.3	.9
19	0.9	1.45	1.1	1.4	1.25	1.0	.8	.....	1.0	1.4	1.55	1.3	1.3	.9
20	.9	1.35	1.2	1.4	1.25	1.0	.85	.....	1.1	1.4	1.55	1.3	1.3	.9
21	.9	1.3	1.2	1.4	1.1	1.0	.85	.....	1.1	1.4	1.55	1.3	1.3	.9
22	.95	1.2	1.1	1.25	1.1	1.0	.85	.....	1.1	1.4	1.55	1.3	1.3	.9
23	.95	1.2	1.1	1.3	1.1	1.0	.85	.....	1.1	1.4	1.55	1.3	1.3	.9
24	.9	1.2	1.2	1.3	1.2	1.0	.85	.....	1.1	1.45	1.55	1.25	1.3	.9
25	.9	1.3	1.25	1.4	1.15	1.0	.85	1.05	1.1	1.45	1.55	1.25	1.3	.9
26	.9	1.4	1.35	1.4	1.1	1.0	.85	1.05	1.1	1.45	1.55	1.25	1.3	.9
27	.9	1.3	1.35	1.4	1.1	1.0	.9	1.05	1.1	1.45	1.55	1.3	1.3	.9
28	.9	1.45	1.2	1.3	1.1	1.0	.9	1.05	1.1	1.45	1.55	1.25	1.3	.9
29	.85	1.55	1.2	1.25	1.1	1.0	.95	1.05	1.15	1.5	1.6	1.3	1.3	.9
30	.85	1.6	1.25	1.35	1.1	1.0	.9	1.05	1.15	1.5	1.6	1.3	1.3	.9
31	.....	1.7	.....	1.45	1.1	.....	.9	.....	1.15	.....	1.6	1.3	.....	.9

[a] Break in canal.

Rating tables for Wimer canal near Laidlaw, Oreg., for 1907 and 1908.

MAY 1 TO OCTOBER 31, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	17	1.10	27.5	1.60	42
0.70	19	1.20	30	1.70	45
0.80	21	1.30	33	1.80	48
0.90	23	1.40	36		
1.00	25	1.50	39		

APRIL 1 TO OCTOBER 31, 1908.[b]

0.90	10.7	1.20	18.2	1.50	27.0
1.00	13.0	1.30	21.0	1.60	30.0
1.10	15.5	1.40	24.0		

[a] Not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1907 and one during 1908, and is not well defined.

[b] Not applicable for ice or obstructed-channel conditions. It is based on five discharge measurements made during 1908 and is well defined between gage heights 0.6 foot and 1.5 feet.

Monthly discharge of Wimer canal near Laidlaw, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
April 19–30[a]	21	17	19.2	457	C.
May	45	23	32.0	1,970	C.
June	48	18	31.9	1,900	C.
July	39	30	34.6	2,130	C.
August	34	28	30.5	1,880	C.
September	28	24	25.8	1,540	B.
October	28	0	23.3	1,430	B.
The period				11,300	
1908.[b]					
April	14.2	0	10.3	613	A.
May	16.8	13.0	14.7	904	A.
June	27.0	16.8	22.4	1,330	A.
July	30.0	25.5	28.8	1,770	A.
August	30.0	19.6	26.0	1,600	A.
September	21.0	15.5	20.6	1,230	A.
October	21.0	10.7	15.6	959	A.
The period				8,410	

[a] Discharges for April were obtained by the indirect method.

[b] Discharges for 1908 represent the amount of water used for irrigation and are not comparable with those for 1906 and 1907, which represent the amount of water diverted at the intake.

COLUMBIA SOUTHERN CANAL NEAR LAIDLAW, OREG.

This station, which was established May 15, 1906, is located in a flume 200 yards below the head-gate of the canal. The canal was constructed by the Columbia Southern Irrigation Company for the irrigation of about 27,000 acres of land to be reclaimed under the provisions of the Carey Act. The records of gage heights are furnished without cost to the U. S. Geological Survey by the company.

The results obtained are of great value to the State, the company, and to the settlers on the project. The conditions are favorable for good results and the data so far obtained are reliable. The station is maintained during the irrigating season only.

Discharge measurements of Columbia Southern canal near Laidlaw, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
April 14	I. E. Oakes	20	29	1.48	46
May 5	W. P. Hardesty	20	31	1.60	52
1908.					
April 1	H. D. McGlashan	19.5	33	1.68	62
Do	do	19.5	28	1.45	40
Do	do	19.5	20	1.04	16
April 2	do	19.5	29	1.49	44
June 16	J. H. Lewis	19.5	37	1.92	88
June 23	H. D. McGlashan	19.5	38	1.97	93

Daily gage height, in feet, of Columbia Southern canal near Laidlaw, Oreg., for 1907 and 1908.

[G. W. Updike, observer.]

Day.	1907.							1908.						
	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.25	1.45	1.85	2.1	2.2	1.75	1.65	1.45	1.5	1.8	2.1	1.9	1.65	1.65
2	1.5	1.5	1.85	2.1	2.05	1.8	1.7	1.5	1.45	1.8	2.1	1.8	1.65	1.65
3	1.5	1.6	1.9	2.1	1.9	1.8	1.65	1.5	1.45	1.8	2.1	1.8	1.65	1.65
4	1.5	1.6	1.9	2.1	1.9	1.75	1.65	1.55	1.4	1.8	2.1	1.8	1.65	1.65
5	1.4	1.6	2.0	2.1	1.9	1.75	1.65	1.55	1.4	1.8	2.1	1.75	1.65	1.65
6	1.4	1.5	2.0	2.1	1.9	1.8	1.65	1.55	1.5	1.8	2.1	1.7	1.70	1.6
7	1.45	1.6	2.0	2.1	1.9	1.8	1.65	1.55	1.5	1.8	2.1	1.7	1.70	1.6
8	1.45	1.7	2.0	2.1	2.1	1.8	1.65	1.5	1.5	1.85	2.1	1.7	1.65	1.6
9	1.45	1.65	2.0	2.15	1.9	1.75	1.65	1.5	1.5	1.9	2.1	1.65	1.65	1.6
10	1.45	1.7	2.0	2.15	1.8	1.75	1.65	(a)	1.55	1.9	2.1	1.65	1.65	1.6
11	1.45	1.7	2.0	2.15	1.8	1.75	1.65	(a)	1.55	1.9	2.1	1.65	1.65	1.6
12	1.45	1.7	2.0	2.15	1.8	1.75	1.65	(a)	1.55	1.9	2.1	1.65	1.65	1.6
13	1.45	1.7	2.0	2.15	1.75	1.75	1.65	(a)	1.6	1.95	2.1	1.65	1.65	1.65
14	1.45	1.7	2.0	2.15	1.8	1.75	1.65	(a)	1.6	1.95	2.1	1.65	1.65	1.6
15	1.45	1.78	2.0	2.15	1.8	1.75	1.65	(a)	1.6	1.95	2.1	1.65	1.65	1.6
16	1.45	1.78	2.0	2.15	1.8	1.75	1.7	1.2	1.6	1.95	2.1	1.65	1.65	1.6
17	1.45	1.78	2.0	2.2	1.8	1.75	1.7	1.2	1.6	2.0	2.1	1.65	1.65	1.6
18	1.45	1.78	2.0	2.1	1.75	1.75	1.7	1.2	1.6	2.0	2.1	1.65	1.65	1.6
19	1.45	1.78	2.05	2.2	1.75	1.7	1.7	1.2	1.6	2.0	2.1	1.75	1.65	1.6
20	1.45	1.78	2.05	2.2	1.75	1.7	1.7	1.5	1.6	2.0	2.1	1.75	1.65	1.6
21	1.45	1.8	2.05	2.2	1.7	1.7	1.7	1.5	1.65	1.9	2.1	1.75	1.65	1.6
22	1.45	1.8	2.05	2.1	1.7	1.7	1.7	1.5	1.65	1.95	2.1	1.75	1.65	1.6
23	1.4	1.85	2.05	2.1	1.7	1.7	1.7	1.45	1.7	2.0	2.1	1.75	1.65	1.6
24	1.4	1.85	2.05	2.2	1.9	1.7	1.7	1.45	1.75	2.0	2.1	1.7	1.65	1.6
25	1.4	1.85	2.05	2.2	1.85	1.7	1.7	1.45	1.75	2.0	2.1	1.7	1.65	1.6
26	1.4	1.85	2.05	2.2	1.8	1.7	1.7	1.5	1.75	2.0	2.1	1.7	1.65	1.6
27	1.4	1.85	2.05	2.1	1.8	1.7	1.7	1.5	1.75	2.0	2.1	1.7	1.65	1.6
28	1.45	1.85	2.05	2.0	1.8	1.7	1.7	1.45	1.75	2.0	1.9	1.65	1.65	1.6
29	1.45	1.85	2.1	2.0	1.75	1.7	1.7	1.45	1.8	2.0	1.9	1.65	1.65	1.6
30	1.45	1.85	2.1	2.0	1.75	1.7	1.7	1.5	1.8	2.0	2.0	1.65	1.65	1.6
31	.....	1.85	.....	2.1	1.75	.....	1.7	.....	1.8	.....	1.9	1.65	.....	1.6

[a] Water turned out of canal April 10 to 15.

Rating table for Columbia Southern canal near Laidlaw, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	14	1.40	37	1.80	73	2.20	126
1.10	19	1.50	45	1.90	85	2.30	140
1.20	24	1.60	54	2.00	98	2.40	154
1.30	30	1.70	63	2.10	112		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 13 discharge measurements made during 1906–1968, and is well defined between gage heights 1.0 feet and 2.0 feet.

Monthly discharge of Columbia Southern canal near Laidlaw, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
April	45	27	40.0	2,380	A.
May	79	41	66.9	4,110	A.
June	112	79	99.1	5,900	A.
July	126	98	116	7,130	A.
August	126	63	77.8	4,780	A.
September	73	63	66.8	3,970	A.
October	63	58	60.7	3,730	A.
The period	126	27	75.3	32,000	
1908.					
April	50	0	33.1	1,970	A.
May	73	37	54.9	3,380	A.
June	98	73	88.4	5,260	A.
July	112	85	109	6,700	B.
August	85	58	63.7	3,920	A.
September	63	58	58.3	3,470	A.
October	58	54	54.8	3,370	A.
The period	112	0	66.0	28,100	

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Deschutes River drainage basin during 1907 and 1908:

Miscellaneous measurements in Deschutes River basin, Oregon, in 1907–8.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
September 29, 1908	Deschutes River	Columbia River	Deschutes L. & P. Co.'s proposed dam, sec. 6, T 24 S., R. 9 E.		69
Do	do	do	Below East Fork		106
August 23, 1908	do	do	Lower crossing, 4 miles below Tetherow.		1,400
August 26, 1908	do	do	Above mouth of Metolius River.		[a]1,600
October 25, 1908	West Fork	Deschutes River	Crane Prairie		213
October 1, 1908	Odell Creek	West Fork of Deschutes River.	Outlet of Odell Lake		39
Do	Crescent Creek	do	Outlet of Crescent Lake		50
April 13, 1907	Spring Creek [b]	Deschutes River	West's ranch, near Lava		299
March 26, 1908	do [b]	do	do	[c]−2.40	271
June 18, 1908	Swalley canal	do	Bend		21
August 27, 1908	Anderson ditch	do	Tumalo bridge, Bend		1
Do	Tumalo Creek	do	Above all diversions		78
September 27, 1908	do	do	Below all diversions		0.5
June 24, 1908	Wimer & Jensen canal.	Tumalo Creek	Tumalo, just below division box.		14
Do	do	do	Tumalo, 2 miles below division box.		12
May 5, 1907	Wimer canal	do	Laidlaw, below waste gate.		8.1
September 27, 1908	do	do	2½ miles below intake		13
June 24, 1908	do	do	6 miles below intake, above division box.		21
May 5, 1907	Columbia Southern canal.	do	Laidlaw, 3 miles below head works.		39
May 6, 1907	do	do	Laidlaw, 7 miles below head works.		34
June 16, 1908	do	do	Sisters bridge, 7½ miles below intake.		64

[a] Estimated.
[b] This stream, which has its source in several large springs, is only 1 mile in length.
[c] Below 8-penny nail in end of log in upstream end of second pier from left bank.

Miscellaneous measurements in Deschutes River basin, Oregon, in 1907–8—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
September 27, 1908	Columbia Southern canal.	Tumalo Creek	2½ miles below intake		44
Do	Wasteway	Columbia Southern canal.			.5
April 12, 1907	Squaw Creek	Deschutes River	Sisters	[a]—3.7	46
August 23, 1908	do	do	Sisters road crossing		10
March 31, 1908	Three Creeks	Squaw Creek	Gist	.83	4.9
June 26, 1908	do	do	do	1.43	18
April 11, 1907	Squaw Creek ditch	do	Sisters	[b]—2.2	28
March 30, 1908	McAllister canal	do	Sisters, near intake	(c)	4.6
June 25, 1908	do	do	do	(c)	22
August 18, 1908	Crooked River	Deschutes River	Below junction of north and south forks.		25
August 23, 1908	do	do	Trail crossing		7
August 19, 1908	do	do	Prineville		5
August 20, 1908	Ochoco Creek	Crooked River	do		2
August 24, 1908	Metolius River	Deschutes River	600 feet below head		100
Do	do	do	Cover's ranch below junction with Jack Creek.		540
August 25, 1908	do	do	Allenghanis' ranch, Sec. 25, T 11 S, R 11 E.		1,480
August 26, 1908	do	do	Mouth		[d]1,800
October 15, 1908	Shitike Creek	do	Warm Springs Agency		61
August 18, 1908	Beaver Creek	Warm Springs River.	Paulina		5

[a] Below center of top log on upstream side of bridge on left bank.
[b] Below top of post on left bank, downstream side.
[c] Made between intake and first waste.
[d] Estimated.

HOOD RIVER DRAINAGE BASIN.

DESCRIPTION.

Hood River drains the northern slopes of Mount Hood. It is formed by the junction of the East and West forks, which drain opposite sides of the mountain, and flows northeastward into Columbia River at Hood River. The waters of the stream are used for both water power and irrigation, and, being supplied from the glaciers on the mountain, the flow is well maintained through the summer months. The drainage area is heavily forested although part of the area was burned many years ago. The mean annual precipitation at Hood River is 36 inches. The valley of the stream is noted for its production of apples, berries, and other fruit. The following gaging stations have been maintained:

Hood River at Tucker's Bridge (1897 to 1899).
Hood River at Winans (1905 to 1907).

HOOD RIVER AT WINANS, OREG.

This station was established November 17, 1905, and abandoned March 31, 1907, because it was impossible to obtain continuous gage-height records. It was located 300 feet below the junction of the East and West forks at Winans, 10½ miles above Hood River, Oreg.

The data obtained at this station are of considerable scientific interest and economic value. The waters of the stream are largely

used for both irrigation and water power. The stream is supplied by glaciers and its drainage area is very heavily forested. The flow is well maintained throughout the summer months. The gage datum was not changed. During the maintenance of the station the conditions were not favorable for reliable results. High waters caused changes in the channel and rerating was necessary after each change. No measurements were made during 1907.

Daily gage height, in feet, of Hood River at Winans, Oreg., for 1907.

[W. R. Winans, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.0	2.0	2.2	16	1.2	2.0	1.4
2	2.0	2.0	2.1	17	1.2	2.2	.....
3	3.0	2.0	2.0	18	1.2	2.2	.....
4	2.6	3.0	2.0	19	1.2	2.2	.....
5	2.4	5.4	2.0	20	1.2	2.3	.....
6	2.2	4.6	2.0	21	1.2	2.3	.....
7	2.0	4.0	1.9	22	1.2	2.3	.....
8	2.0	3.6	1.9	23	1.2	2.3	.....
9	1.8	3.0	1.9	24	1.2	2.5	.....
10	1.7	2.9	1.9	25	1.2	2.6	.....
11	1.7	2.7	1.9	26	1.2	2.4	.....
12	1.6	2.5	1.8	27	1.2	2.2	.....
13	1.4	2.4	1.7	28	1.2	2.2	.....
14	1.2	2.2	1.6	29	1.2	.....	.....
15	1.2	2.0	1.5	30	2.4	.....	.....
				31	2.2	.....	.....

Rating table for Hood River at Winans, Oreg., for 1905, 1906, and 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	910	2.00	1,595	2.80	2,360	4.00	3,560
1.30	990	2.10	1,685	2.90	2,460	4.20	3,780
1.40	1,070	2.20	1,780	3.00	2,560	4.40	4,000
1.50	1,155	2.30	1,875	3.20	2,760	4.60	4,220
1.60	1,240	2.40	1,970	3.40	2,960	4.80	4,440
1.70	1,325	2.50	2,065	3.60	3,160	5.00	4,660
1.80	1,415	2.60	2,160	3.80	3,360	6.00	5,860
1.90	1,505	2.70	2,260				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 6 discharge measurements made during 1905–6, and is well defined between gage heights 0.5 foot and 2.0 feet.

Monthly discharge of Hood River at Winans, Oreg., for 1907.

[Drainage area, 370 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile	Depth in inches on drainage area.	Total in acre-feet.	
January	2,560	910	1,280	3.46	3.99	78,700	C.
February	5,140	1,600	2,230	6.03	6.28	124,000	D.
March 1–16	1.780	1.070	1.470	3.97	2.36	46.700	C.

SANDY RIVER DRAINAGE BASIN.

DESCRIPTION.

Sandy River has its source in the glaciers of Mount Hood and flows northwestward, uniting with Columbia River at Troutdale. It drains the eastern slope of the Cascade Mountains at the very northern extremity in Oregon. The principal tributaries are Bull Run River, which drains the Bull Run National Forest and furnishes the water supply for the city of Portland; Salmon River, the Little Sandy, and Zigzag, Camp, and Still creeks. The elevation at Bull Run post-office is 647 feet above sea level; at Salmon post-office, 1,000 feet; at Bull Run Lake, 3,161 feet; and at Government Camp, 3,880 feet. The summit of Zigzag Mountain is 5,014 feet in altitude and that of Mount Hood 11,225 feet. The drainage area includes 521 square miles at the mouth of the river, 228 square miles above the mouth of Bull Run, and 118 square miles above the mouth of Zigzag Creek. The drainage area of Bull Run River at the mouth is 168 square miles.

The mean annual precipitation at Bull Run is 76 inches, at Government Camp 87. It is likely, however, that the figure for Government Camp is not representative, because of the close proximity of the station to Mount Hood. A large part of the precipitation on the headwaters falls as snow. In the foothills, however, it nearly all appears as rain during the nine months from September to May. The value of the waters of this stream lie in their availability for municipal water supplies and in the power that can be generated by them. Favorable sites for power development are numerous and the distance to an industrial center is not great. A large portion of the drainage area is heavily forested, although there are many areas from which the timber was burned a good many years ago. These areas have, however, grown up in second-growth timber and the underbrush is almost impenetrable.

Estimates of maximum and minimum values can not be made, as the records do not cover a sufficiently long period. Judging from records kept in adjacent areas, the maximum discharge during recent years probably occurred in the winter of 1907 and the minimum in September or October of 1905. As is usual with glacial streams, a protracted period of cold weather is very likely to cause lower water for a short period in winter than the natural low-water flow in the summer time. Such a condition, however, would not occur except after an exceptionally dry fall. The waters are milky during the summer months.

The following gaging stations are maintained in this river basin:

Sandy River at Salmon post-office (1908).
Bull Run River near Bull Run (1907 and 1908).

SANDY RIVER AT SALMON, OREG.

This station was established December 12, 1907, at a highway bridge 1 mile below Salmon post-office. It is 1 mile below the mouth of Salmon River. This station furnishes data of value chiefly in connection with water-power development.

Conditions at the station are favorable for individual measurements of considerable accuracy during medium and low stages; at a high stage, however, the current is very swift and somewhat turbulent. During the summer months glacial silt is deposited, which destroys the stability of the rating, and on this account the final results are not as accurate as could be desired.

Discharge measurements of Sandy River at Salmon, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 6	J. C. Stevens	87	326	3.43	448
December 12	McGlashan and Ellsworth	96	535	5.45	2,270
1908.					
July 24	H. D. McGlashan	89	354	3.80	695
October 8	L. R. Allen	83	175	3.43	323

Daily gage height, in feet, of Sandy River at Salmon, Oreg., for 1907 and 1908.

[J. T. McIntyre, observer.]

Day.	Dec., 1907.	1908.											
		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.2	4.25	4.35	4.95	5.4	6.2	4.5	3.6	3.8	3.6	5.2	4.05
2	.....	5.05	4.05	4.4	5.0	5.2	6.1	4.5	3.65	3.75	3.85	4.75	3.85
3	.....	4.95	4.05	4.35	5.3	5.1	5.85	4.4	3.6	3.7	3.7	4.55	3.8
4	.....	4.9	4.15	4.15	5.1	4.9	5.7	4.4	3.6	3.65	3.7	4.2	3.7
5	.....	5.1	4.7	4.05	4.8	4.9	5.5	4.3	3.5	3.55	3.6	4.05	6.65
6	.....	5.2	5.2	4.0	4.9	4.95	5.45	4.25	3.5	3.55	3.55	3.95	6.65
7	.....	5.0	4.45	3.95	4.75	5.15	5.4	4.25	3.5	3.6	3.45	3.9	6.65
8	.....	4.95	4.55	3.95	4.8	5.1	5.45	4.2	3.5	3.75	3.43	3.75	3.75
9	.....	5.25	4.4	4.0	4.75	5.0	5.65	4.2	3.55	3.65	3.45	3.65	3.65
10	.....	5.05	4.15	4.05	4.9	4.9	5.55	4.2	3.5	3.6	3.45	3.6	3.55
11	.....	5.6	4.3	4.15	5.2	4.95	5.4	4.2	3.5	3.55	3.6	3.55	3.6
12	5.45	5.4	4.25	4.8	5.4	4.9	5.0	4.15	3.55	3.5	3.75	3.5	5.0
13	7.0	5.2	4.2	6.4	5.4	4.9	4.9	4.1	3.6	3.5	4.25	3.5	5.15
14	6.05	5.05	4.1	8.4	5.55	4.85	4.9	4.05	3.5	3.6	5.0	3.45	4.9
15	5.4	4.8	4.2	13.6	5.5	5.1	4.85	4.05	3.55	3.6	4.75	3.45	4.3
16	5.05	4.7	4.5	10.1	5.65	5.55	4.8	4.0	3.5	3.6	4.7	3.4	4.1
17	4.85	4.75	4.65	7.9	6.0	5.4	4.85	3.95	3.45	3.55	4.35	3.45	4.0
18	4.7	4.8	4.65	6.7	6.3	5.75	5.0	3.95	3.4	3.55	4.1	4.9	3.9
19	4.6	5.0	4.4	6.1	6.2	5.7	5.1	3.95	3.45	3.5	4.35	4.2	3.75
20	4.7	5.55	4.2	5.9	6.25	5.6	5.15	3.95	3.5	3.45	5.15	4.55	3.75
21	7.3	5.15	4.15	5.5	6.0	5.55	5.1	4.0	3.5	3.55	4.6	4.75	3.8
22	9.8	4.9	4.15	5.3	5.8	5.4	5.1	4.0	3.45	3.5	4.4	4.95	3.85
23	9.8	4.8	4.1	5.05	5.5	5.2	5.05	3.95	3.45	3.45	4.25	4.7	3.9
24	8.6	4.65	4.05	5.35	6.6	5.2	4.9	3.9	3.4	3.45	4.1	4.5	3.85
25	7.6	4.5	4.15	5.3	6.05	5.15	4.85	3.8	3.4	3.4	4.05	4.35	3.75
26	9.1	4.45	4.2	5.25	5.85	5.15	4.75	3.7	3.45	3.4	4.1	4.2	4.9
27	7.2	4.45	4.7	5.15	5.6	5.2	5.0	3.65	3.45	3.4	4.1	4.05	5.05
28	6.4	4.3	4.6	5.1	5.45	5.2	7.0	3.65	3.45	3.4	4.05	4.0	6.1
29	5.95	4.45	4.45	5.3	5.3	5.25	6.65	3.6	3.95	3.45	4.05	4.0	5.5
30	5.5	4.3	.....	5.15	5.2	5.1	6.0	3.65	4.1	3.5	4.2	4.2	5.1
31	5.1	4.25	.....	5.05	.....	5.25	.....	3.6	3.9	.....	6.2	.....	4.85

Rating table for Sandy River at Salmon, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	365	4.60	1,310	5.80	2,750	7.00	4,850
3.50	425	4.70	1,410	5.90	2,900	7.20	5,250
3.60	490	4.80	1,515	6.00	3,050	7.40	5,660
3.70	555	4.90	1,620	6.10	3,210	7.60	6,090
3.80	625	5.00	1,730	6.20	3,370	7.80	6,540
3.90	700	5.10	1,840	6.30	3,540	8.00	7,000
4.00	780	5.20	1,960	6.40	3,720	9.00	9,800
4.10	860	5.30	2,080	6.50	3,900	10.00	13,000
4.20	945	5.40	2,200	4.60	4,090	11.00	16,700
4.30	1,030	5.50	2,330	6.70	4,280	12.00	21,000
4.40	1,120	5.60	2,470	6.80	4,470	13.00	25,800
4.50	1,215	5.70	2,610	6.90	4,660	14.00	31,000

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1907 and 1908, and is fairly well defined below gage height 5.5.

Monthly discharge of Sandy River at Salmon, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
December 12–31	12,400	1,310	4,560	181,000	C.
1908.					
January	2,470	988	1,630	100,000	B.
February	1,960	820	1,080	62,100	B.
March	28,900	740	3,370	207,000	C.
April	4,090	1,460	2,350	140,000	B.
May	2,680	1,570	1,960	121,000	B.
June	4,850	1,460	2,240	133,000	B.
July	1,220	490	817	50,200	B.
August	860	365	460	28,300	C.
September	625	365	459	27,300	C.
October	3,370	383	940	57,800	B.
November	1,960	365	910	54,100	B.
December	4,180	458	1,380	84,800	B.
The year	28,900	365	1,470	1,070,000	

BULL RUN RIVER NEAR BULL RUN, OREG.

This station was established August 20, 1907, by the water board of the city of Portland in cooperation with the United States Geological Survey. It is situated about 1½ miles above the intake of a 30-mile pipe line that supplies the city of Portland with water. The gage is located just above a small wing dam construction which diverts water into the pipe line. The measurements are made from a cable about 1½ miles above this point. This wing dam is merely a rock-and-brush affair which is built during the low-water period. It washes out at the first freshet in the fall. Its effect has been detrimental to accurate results on account of backwater effect at the gage.

The facilities are good for accurate gagings. The drainage area of this stream is completely and densely forested and the water is exceptionally clear and pure.

Discharge measurements of Bull Run River near Bull Run, Oreg., 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 20	Stevens and Clark	113	138	0.12	100
December 10	McGlashan and Ellsworth	127	347	2.95	1,080
December 11	do	134	517	4.40	2,500
1908.					
July 23	H. D. McGlashan	115	168	0.53	159
October 7 [a]	L. R. Allen	110	126	0.24	82

[a] Made with defective meter.

Daily gage height, in feet, of Bull Run River near Bull Run, Oreg., for 1907 and 1908.

[Portland Water Board, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.						1907.					
1	.....	0.45	0.97	0.64	2.70	16	.....	1.55	0.38	0.97	2.85
2	.....	.38	1.23	1.30	2.35	17	.....	1.47	.37	.77	2.50
3	.....	.35	.97	.87	2.10	18	.....	1.12	.37	.76	2.18
4	.....	.31	.88	.73	1.92	19	.....	.90	.35	1.87	2.04
5	.....	.27	.77	.67	2.08	20	0.12	.86	.33	3.22	2.55
6	.....	.25	.78	.60	1.88	21	.11	.66	.32	3.95	5.36
7	.....	.25	.73	.54	3.45	22	.11	.57	.32	5.12	7.10
8	.....	.22	.59	.50	2.85	23	.10	.49	.31	4.67	6.95
9	.....	.19	.53	47	3.40	24	.30	.45	.30	8.00	5.25
10	.....	.17	.46	.49	2.90	25	.70	.44	.28	5.70	5.40
11	.....	.18	.44	.39	4.36	26	1.38	.42	.27	5.00	5.40
12	.....	.26	.39	.38	4.10	27	.79	.60	.25	3.90	4.10
13	.....	.17	.40	.40	5.15	28	.58	.90	.28	4.00	3.60
14	.....	.15	.43	.80	4.10	29	.53	.63	.74	3.70	3.10
15	.....	.30	.42	.66	3.30	30	.51	.52	.78	3.10	2.80
						31	.45	.....	.96	.....	2.50

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.55	1.25	1.68	2.40	2.27	2.43	1.60	0.41	0.56	0.40	2.90	1.90
2	2.70	1.20	1.57	2.38	2.16	2.50	1.50	.40	.50	.44	2.39	1.70
3	2.60	1.50	1.51	2.53	2.18	2.33	1.40	.39	.46	.32	2.04	1.60
4	2.65	1.30	1.45	2.48	2.06	2.34	1.38	.38	.42	.28	1.76	1.45
5	3.40	2.75	1.41	2.26	1.90	2.23	1.30	.37	.39	.27	1.56	1.32
6	3.10	3.15	1.35	2.20	1.90	2.10	1.20	.36	.37	.25	1.40	1.22
7	2.65	2.70	1.24	2.00	2.00	2.00	1.12	.35	.44	.24	1.28	1.18
8	3.00	2.35	1.19	1.90	2.10	2.00	1.05	.34	.78	.23	1.17	1.35
9	2.90	2.10	1.17	2.00	1.98	2.00	1.00	.32	.43	.20	1.07	1.28
10	2.65	1.90	1.19	2.00	1.83	1.95	.95	.31	.40	.20	1.00	1.18
11	3.50	1.90	1.45	2.10	1.83	1.83	.90	.30	.38	.28	.92	1.10
12	3.05	1.80	2.54	2.25	1.80	1.75	.86	.30	.36	.33	.86	3.05
13	2.74	1.70	4.20	2.40	1.60	1.60	.81	.48	.36	1.66	.80	3.20
14	2.60	1.60	6.60	2.36	1.64	1.55	.76	.38	.34	3.57	.76	2.50
15	2.30	1.78	8.80	2.34	2.48	1.47	.75	.33	.33	3.49	.71	2.18
16	2.20	2.00	6.35	2.30	3.20	1.40	.84	.33	.31	3.25	.70	1.95
17	2.80	2.32	4.65	3.95	3.10	1.45	.73	.33	.31	2.52	.72	1.70
18	2.50	2.14	3.70	4.30	3.50	2.02	.68	.32	.28	2.00	3.05	1.55
19	3.05	2.00	3.15	3.85	3.40	2.50	.64	.32	.27	3.35	1.90	1.42
20	3.15	1.84	2.90	3.50	3.30	2.53	.60	.31	.26	3.45	2.50	1.33
21	2.90	1.70	2.64	3.05	3.10	2.40	.58	.30	.26	2.60	2.85	1.32
22	2.60	1.59	2.40	2.67	3.00	2.20	.58	.29	.27	2.20	3.95	1.35
23	2.25	1.57	2.30	2.60	2.74	1.98	.54	.29	.27	1.90	3.75	2.55
24	2.10	1.48	2.40	4.35	2.60	1.82	.52	.33	.26	1.70	3.00	2.07
25	1.90	1.54	2.50	3.40	2.45	1.75	.50	.41	.25	1.59	2.54	2.80
26	1.75	1.65	2.50	2.90	2.30	1.74	.50	.38	.24	1.48	2.16	3.12
27	1.60	1.98	2.30	2.70	2.12	2.40	.49	.35	.25	1.37	1.95	4.43
28	1.50	1.92	2.20	2.42	1.97	2.00	.49	1.50	.25	1.30	1.75	5.18
29	1.85	1.80	2.18	2.30	2.10	1.82	.47	1.75	.25	1.40	1.75	3.90
30	1.55	.....	2.72	2.28	2.16	1.70	.46	.90	.23	2.25	2.20	3.15
31	1.37	.....	2.46	.....	2.12	.....	.45	.67	.....	3.85	.....	2.60

NOTE.—A low log-and-brush dam was built about 100 feet below the gage during the summer of 1908; it was completed July 16. It was partially destroyed by the rise of August 28 and 29, but was immediately repaired. It was washed away entirely October 14.

Rating tables for Bull Run River near Bull Run, Oreg.

AUGUST 20, 1907, TO JULY 15, 1908, AND OCTOBER 15 TO DECEMBER 31, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	88	1.70	460	3.80	1,790
.10	98	1.80	500	4.00	2,000
.20	110	1.90	540	4.20	2,230
.30	125	2.00	580	4.40	2,480
.40	140	2.10	620	4.60	2,750
.50	155	2.20	665	4.80	3,030
.60	170	2.30	710	5.00	3,330
.70	185	2.40	760	5.20	3,620
.80	205	2.50	810	5.40	3,930
.90	225	2.60	865	5.60	4,270
1.00	250	2.70	925	5.80	4,610
1.10	275	2.80	985	6.00	4,960
1.20	300	2.90	1,050	7.00	6,850
1.30	330	3.00	1,120	8.00	9,030
1.40	360	3.20	1,260	9.00	11,420
1.50	390	3.40	1,420		
1.60	425	3.60	1,600		

JULY 16 TO OCTOBER 14, 1908.[b]

0.20	85	0.90	209	1.60	420
.30	99	1.00	234	1.70	460
.40	114	1.10	261	1.80	500
.50	129	1.20	290	1.90	540
.60	146	1.30	321	2.00	580
.70	165	1.40	353		
.80	186	1.50	386		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907–8, and is well defined between gage heights 0.1 foot and 4.5 feet.

[b] This table is not applicabl for ice or obstructed-channel conditions. It is based on 1 discharge measurement made during 1908, which has been increased 10 per cent as it was made with a meter in poor condition. It may be regarded as fairly well defined. Above gage height 2.0 feet it is the same as the previous table.

Monthly discharge of Bull Run River near Bull Run, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
August 20–31	354	98	158	3,760	A.
September	408	104	165	9,820	A.
October	309	118	164	10,100	A.
November	9,030	137	1,230	73,200	B.
December	7,050	532	1,950	120,000	B.
The period				217,000	
1908.					
January	1,510	351	854	52,500	A.
February	1,220	300	551	31,700	A.
March	10,900	292	1,450	89,200	B.
April	2,420	540	986	58,700	A.
May	1,510	425	777	47,800	A.
June	826	360	586	34,900	A
July	425	122	209	12,990	B.
August	480	98	132	8,120	B.
September	182	89	107	6,370	B.
October	1,840	85	553	34,000	B.
November	1,940	185	606	36,100	A.
December	3,590	275	787	48,400	A.
The year	10,900	85	633	461,000	

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Sandy River drainage basin during 1907 and 1908:

Miscellaneous measurements in Sandy River basin, Oregon, in 1907–8.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 18, 1907	Sandy River	Columbia River	Sandy Bridge, Oreg.		890
September 22, 1907	do	do	3½ miles above Troutdale, Oreg.	1.83	749
August 6, 1907	Salmon Creek	Sandy River	Salmon, Oreg.	[a] −4.87	159
September 12, 1907	do	do	do		126
July 24, 1908	do	do	do	[a] −4.52	222
July 27, 1908	Zigzag Creek	do	Welches, Oreg.	[b] −5.44	147
Do	Still Creek	Zigzag Creek	do	[c] −4.71	62
July 18, 1908	Bull Run Pipe	Bull Run	Headworks, near Bull Run, Oreg.		40

[a] Below bent spike in conglomerate bowlder on right bank below footbridge.
[b] Below 8-penny nail in end of top leg of right abutment, downstream side of bridge.
[c] Below 40-penny spike in end of top leg in right abutment, upstream side of bridge.

WILLAMETTE RIVER DRAINAGE BASIN.

DESCRIPTION.

Willamette River drains a shallow trough-shaped area, extending north and south between the Coast and Cascade ranges in Oregon. The area is roughly rectangular, approximately 230 miles in length and about 85 miles in width. The Willamette proper is formed by the junction of three main tributaries which unite in the vicinity of Eugene; these are the Coast Fork, the Middle Fork, and the McKenzie. The river is navigable for ocean-going vessels from the mouth to Portland, and for ordinary river steamboats from Portland to Corvallis, except during a few months of each year. From Corvallis to Eugene the river is navigable for light-draft boats during medium stages of the river. The falls of Willamette River at Oregon City are passed by a series of five locks, which are at present in private ownership.

The other principal tributaries of the Willamette are Santiam, Mollala, and Clackamas rivers. From the Coast Range flow Long Tom, Marys, Luckiamute, Yamhill, and Tualatin rivers. The drainage areas of this river and its principal tributaries are given in the following table:

Drainage areas in Willamette River Basin.

	Square miles.
Willamette at the mouth	11,150
Willamette at Oregon City	10,200
Willamette at Salem	7,520
Willamette at Albany	4,860
Coast Fork of the Willamette	705
Middle Fork of the Willamette	1,450
McKenzie River	1,040
Santiam River	1,890
Yamhill River	763
Clackamas River	927
Tualatin River	690

From the summit of the mountain ranges the slopes are steep, but they merge gradually into a wide alluvial valley or gently rolling agricultural lands.

The entire drainage area of this river was originally primeval forest, and although considerable areas in the valley have been cleared for agriculture the area may still be considered densely forested. The portions of the basin that contribute to the flow of the streams are almost entirely within the boundaries of the national forests, while the privately owned timber lands extend from the boundaries of the national forests to the main stream in the valley, except where lands have been cleared. Thus whatever beneficial influence the original forest may have exerted on the regulation of stream flow, still exists, as the water-producing portions of the area have not been disturbed.

The mean annual rainfall presents some rather peculiar features. Although precipitation records at the summit of the Coast Range are meager, it is likely that the total annual rainfall is as much as 150 inches. As the eastern slope of the Coast Range is descended, precipitation falls very rapidly to about 40 inches, but gradually increases again until at the summit of the Cascade Range it is approximately 100 inches annually. From north to south the same general variation is observed; although the differences are not so striking. At the mouth of the river the precipitation is approximately 50 inches, which gradually decreases to about 40 in the vicinity of Corvallis, but increases again to 55 or 60 inches at the summit of the Calapooia Mountains, which form the southern boundary of the drainage area. Except on the summit of the mountain ranges this precipitation appears almost entirely as rainfall, 95 per cent falling during nine months, from September to May. On the mountain ranges part of the precipitation is snowfall, and the country is subject during the spring and fall to warm "chinook" winds, accompanied by rather sudden melting of these snows, which frequently cause considerable damage from floods. During the growing season when the precipitation rarely exceeds 2 inches, the country is practically an arid section. Although irrigation has not been practiced in the valley, it is likely that before many years a large part of the agricultural bottom lands will be placed under irrigation. Small ditches and pumping plants have been constructed, and the returns from irrigated agriculture lands show an increase from 50 to 500 per cent in production over the non-irrigated lands.

No portion of this area has ever been mapped topographically, so that it is impossible to determine the extent of storage facilities. The operation of storage reservoirs would, however, greatly increase the economic value of this river system, as it would probably render the river navigable from Eugene to its mouth during all portions of

the year and at the same time diminish the damage from floods that annually threaten the agricultural lands and the industries of the valley. It would also make the river many times more valuable than it is at present for water-power development. If storage facilities for impounding 850,000 acre-feet per annum could be found, the navigability of the river from Eugene to the mouth would be assured, and the entire cost of construction would be more than returned from benefits which would accrue in increased water-power facilities at Oregon City alone.

The highest known flood in the Willamette Valley occurred December, 1861, when the discharge at Albany was 220,000 cubic feet per second. The highest gage reading at Portland since that date occurred in 1894, but was due to backwater from Columbia River. The years 1899 and 1907 were "wet years." The year 1905 was a comparatively dry year. The longest record of stream flow in this basin has been obtained by applying recent measurements made at Albany to records obtained by the United States Weather Bureau since 1895.

The following gaging stations have been maintained in this river basin:

Middle Fork of Willamette River at Jasper (1905 to 1908).
Willamette River at Albany (1895 to 1908).
Coast Fork of Willamette River at Goshen (1905 to 1908).
McKenzie River near Springfield (1905 to 1908).
North Fork of Santiam River at Detroit (1907 to 1908).
North Fork of Santiam River at Mehama (1905 to 1907).
Santiam River at Jefferson (1905, 1906, and 1908).
Marion Fork of Santiam River at Marion Lake, near Detroit (1907).
Puzzle Creek near Detroit (1907).
Permelia Creek near Detroit (1907).
Whitewater Creek near Detroit (1907).
South Fork of Santiam River at Waterloo (1905 to 1907).
Luckiamute River near Suver (1905 to 1908).
South Fork of Yamhill River at Sheridan (1906 to 1908).
Yamhill River at Lafayette (1908).
Molalla River near Molalla (1905 to 1908).
Clackamas River at Barton and Estacada (1905 to 1908).

MIDDLE FORK OF WILLAMETTE RIVER AT JASPER, OREG.

This station was established September 16, 1905, and has been maintained continuously since that date, although owing to loss of gaging equipment during the flood of February, 1907, no gagings were made during that year. The equipment was replaced October 13, 1908, and subsequent measurements have developed a curve that is applicable to the gage heights obtained during the interval. The station is located at the ferry near Jasper post-office, 2 miles above Natron and 3 miles below the mouth of Fall Creek.

The waters of this stream are particularly valuable for water power, and will no doubt be used in the future for irrigation. The records also furnish some very reliable data concerning the run-off from heavily forested areas where the precipitation is high. The stream is largely used for transporting logs during all seasons of the year, and records of flow are therefore somewhat unreliable during the low-water periods, as logs frequently ground on the bars below the station and cause backwater on the gage. Except for this, the records are reliable, and no change of gage datum has occurred since the station was established.

Discharge measurements of Middle Fork of Willamette River at Jasper, Oreg., in 1907, 1908, and 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
January 30	I. E. Oakes	396	2,730	7.10	21,100
1908.					
October 12	H. D. McGlashan	363	684	2.22	1,060
1909.					
January 16	do	448	3,630	9.30	35,700
Do	do	446	3,400	8.80	31,900
January 17	do	438	2,890	7.55	21,000

Daily gage height, in feet, of Middle Fork of Willamette River at Jasper, Oreg., for 1907 and 1908.

[Phillip Sylvester, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.8	7.9	3.9	3.8	3.1	3.0	2.4	1.7	1.6	1.7	1.6	3.0
2	3.7	7.5	3.8	3.8	3.0	2.9	2.5	1.7	1.6	1.9	1.8	2.9
3	5.7	9.5	3.7	3.6	3.0	2.9	2.5	1.7	1.6	1.8	1.9	2.7
4	11.0	12.3	3.6	3.4	3.0	2.8	2.6	1.7	1.6	1.7	1.7	2.5
5	7.1	14.4	3.4	3.6	2.9	2.8	2.5	1.7	1.6	1.6	1.6	2.7
6	5.7	13.45	3.3	5.7	2.9	2.7	2.4	1.7	1.6	1.6	1.6	2.5
7	5.0	8.4	3.4	10.35	3.0	2.7	2.6	1.7	1.6	1.6	1.6	2.5
8	4.5	7.0	3.3	7.9	2.9	2.7	2.7	1.8	1.6	1.6	1.6	3.0
9	4.1	6.2	3.2	6.6	3.0	2.6	2.2	2.0	1.6	1.6	1.5	2.7
10	4.0	5.8	3.3	6.6	3.1	2.5	2.1	2.0	1.6	1.5	1.5	3.0
11	3.7	5.5	3.3	6.1	3.5	2.9	2.0	1.9	1.5	1.5	1.5	3.7
12	3.7	5.2	3.3	5.8	3.4	3.3	2.0	1.8	1.5	1.5	1.5	3.6
13	3.5	4.9	3.2	5.7	3.2	3.1	2.0	1.7	1.5	1.5	1.5	6.5
14	3.4	4.6	3.2	5.5	3.0	3.1	1.9	1.7	1.5	1.5	1.6	5.8
15	3.2	4.4	3.1	5.1	2.9	3.1	2.0	1.7	1.5	1.5	2.0	4.7
16	3.1	4.3	3.0	4.7	2.9	3.0	2.0	1.7	1.5	1.5	1.7	4.0
17	3.0	4.3	3.0	4.4	3.2	2.9	1.9	1.7	1.8	1.5	1.7	4.5
18	2.8	4.0	5.4	4.2	3.2	2.8	1.9	1.7	1.7	1.5	1.7	3.6
19	2.9	3.9	5.5	4.8	3.5	2.7	1.9	1.7	1.6	1.5	1.7	3.4
20	2.8	3.7	6.5	4.7	3.5	2.7	1.8	1.6	1.6	1.5	2.4	3.9
21	2.8	3.6	5.7	4.4	3.4	2.6	1.8	1.6	1.5	1.5	3.2	6.6
22	2.8	3.6	5.0	4.3	3.3	2.6	1.8	1.6	1.5	1.5	2.9	10.5
23	3.0	3.7	4.8	4.2	3.2	2.6	1.8	1.6	1.5	1.5	3.6	9.8
24	3.3	3.6	4.5	4.1	3.1	2.6	1.8	1.6	1.5	1.5	5.8	8.6
25	3.6	4.0	4.2	3.9	3.0	2.6	1.8	1.8	1.5	1.5	6.4	10.6
26	3.8	4.1	4.0	3.6	3.0	2.5	1.8	1.8	1.5	1.5	5.0	13.7
27	4.0	3.8	3.8	3.5	2.9	2.5	1.8	1.7	1.5	1.5	4.3	9.5
28	5.0	3.6	3.7	3.4	2.9	2.5	1.8	1.7	1.7	1.5	3.8	7.4
29	7.5	.....	3.7	3.3	2.9	2.4	1.8	1.6	1.7	1.5	3.6	6.4
30	7.0	.....	3.7	3.2	2.9	2.4	1.8	1.6	1.7	1.8	3.8	5.5
31	6.8	.....	3.8	.....	2.8	.....	1.8	1.6	.....	1.7	.....	5.2

Daily gage height, in feet, of Middle Fork of Willamette River at Jasper, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5.3	3.3	3.6	4.3	4.0	3.6	3.5	2.4	2.3	2.1	3.7	3.0
2	5.0	3.3	3.5	4.2	4.0	3.6	3.5	2.4	2.3	2.1	3.4	3.0
3	4.8	3.3	3.5	4.3	4.0	3.6	3.5	2.4	2.2	2.2	3.2	2.9
4	4.8	3.3	3.5	4.3	4.0	3.7	3.4	2.4	2.2	2.2	3.1	2.9
5	4.6	3.3	3.4	4.1	3.7	3.6	3.3	2.4	2.2	2.2	3.0	2.8
6	4.6	3.7	3.3	4.0	3.6	3.6	3.2	2.4	2.2	2.1	2.9	2.8
7	4.4	4.7	3.3	3.9	3.9	3.6	3.2	2.4	2.2	2.1	2.8	2.7
8	4.3	4.3	3.2	3.7	4.2	3.7	3.1	2.3	2.3	2.1	2.7	2.7
9	6.0	4.3	3.2	3.6	4.1	3.9	3.1	2.3	2.3	2.1	2.7	2.7
10	5.6	4.1	3.2	3.5	3.9	4.1	2.9	2.3	2.2	2.0	2.6	2.7
11	5.1	4.0	3.3	3.7	3.8	4.2	2.9	2.3	2.2	2.0	2.6	2.6
12	4.9	4.0	3.3	3.9	3.7	4.1	2.9	2.3	2.2	2.1	2.5	2.6
13	4.8	3.9	3.4	4.0	3.6	4.0	2.9	2.3	2.2	2.27	2.6	2.9
14	5.0	3.8	3.3	4.1	3.6	4.0	3.1	2.4	2.2	3.6	2.5	3.0
15	5.0	3.8	5.4	4.1	4.0	4.0	2.7	2.4	2.2	6.0	2.5	2.9
16	4.8	3.8	7.3	4.2	4.5	3.9	2.7	2.3	2.2	4.6	2.5	2.9
17	4.6	3.9	7.1	4.0	4.5	3.7	2.7	2.3	2.2	3.8	2.5	2.8
18	4.3	3.9	6.5	4.1	4.6	3.8	2.7	2.3	2.2	3.3	2.6	2.7
19	4.3	3.7	5.8	4.1	5.0	3.8	2.6	2.3	2.2	3.1	3.1	2.7
20	5.0	3.6	5.2	4.2	4.9	3.8	2.6	2.3	2.2	4.0	3.3	2.7
21	4.9	3.5	4.7	4.3	4.6	4.6	2.6	2.3	2.1	3.8	4.8	2.6
22	4.6	3.4	4.7	4.2	4.4	4.2	2.6	2.3	2.1	3.4	4.7	2.8
23	4.4	3.3	4.2	4.1	4.2	4.0	2.6	2.3	2.1	3.3	4.8	3.1
24	4.2	3.3	4.1	4.6	4.1	4.0	2.6	2.3	2.1	3.2	4.7	4.2
25	4.0	3.3	4.2	4.9	4.0	4.0	2.6	2.2	2.1	3.1	4.3	3.6
26	3.9	3.3	4.0	4.5	3.9	3.9	2.5	2.2	2.1	3.0	4.0	4.5
27	3.7	3.5	4.2	4.3	3.8	3.8	2.5	2.2	2.1	3.0	3.8	4.5
28	3.6	3.6	4.3	4.1	3.7	3.7	2.5	2.2	2.1	3.0	3.5	4.5
29	3.6	3.5	3.9	3.9	3.7	3.5	2.5	2.5	2.1	2.95	3.8	5.5
30	3.6	.....	4.2	3.9	3.7	3.5	2.5	2.5	2.1	2.95	3.1	4.7
31	3.4	.....	4.2	.....	3.6	.....	2.5	2.5	.....	3.6	.....	4.7

Rating tables for Middle Fork of Willamette River at Jasper, Oreg.

SEPTEMBER 17, 1905, TO FEBRUARY 2, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	2,870	4.10	6,340	5.40	11,670	7.40	22,900
2.90	3,080	4.20	6,690	5.50	12,150	7.60	24,120
3.00	3,300	4.30	7,050	5.60	12,650	7.80	25,360
3.10	3,520	4.40	7,420	5.70	13,160	8.00	26,600
3.20	3,750	4.50	7,800	5.80	13,680	8.20	27,880
3.30	3,990	4.60	8,190	5.90	14,210	8.40	29,160
3.40	4,240	4.70	8,590	6.00	14,750	8.60	30,440
3.50	4,500	4.80	9,000	6.20	15,860	8.80	31,720
3.60	4,780	4.90	9,420	6.40	16,990	9.00	33,000
3.70	5,070	5.00	9,850	6.60	18,150	10.00	39,700
3.80	5,370	5.10	10,290	6.80	19,320	11.00	46,500
3.90	5,680	5.20	10,740	7.00	20,500		
4.00	6,000	5.30	11,200	7.20	21,700		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 8 discharge measurements made during 1905–1907, and is well defined between gage heights 2.80 feet and 4.0 feet.

Rating tables for Middle Fork of Willamette River at Jasper, Oreg—Continued.

FEBRUARY 3, 1907, TO DECEMBER 31, 1908.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	530	3.00	2,110	4.50	5,680	7.00	17,600
1.60	590	3.10	2,290	4.60	6,000	7.20	18,860
1.70	660	3.20	2,480	4.70	6,340	7.40	20,200
1.80	730	3.30	2,670	4.80	6,700	7.60	21,600
1.90	800	3.40	2,870	4.90	7,080	7.80	23,060
2.00	880	3.50	3,080	5.00	7,480	8.00	24,600
2.10	960	3.60	3,300	5.20	8,330	9.00	33,000
2.20	1,050	3.70	3,520	5.40	9,200	10.00	42,400
2.30	1,150	3.80	3,750	5.60	10,110	11.00	52,800
2.40	1,260	3.90	3,990	5.80	11,060	12.00	64,000
2.50	1,380	4.00	4,240	6.00	12,050	13.00	76,000
2.60	1,510	4.10	4,500	6.20	13,080	14.00	88,500
2.70	1,650	4.20	4,780	6.40	14,150	15.00	101,000
2.80	1,790	4.30	5,070	6.60	15,260		
2.90	1,940	4.40	5,370	6.80	16,410		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 4 discharge measurements made during 1908–9 and the form of the previous curves, and is well defined between gage heights 2.0 feet and 10.0 feet. It is somewhat uncertain at low stages for 1907.

Monthly discharge of Middle Fork of Willamette River at Jasper, Oreg., for 1907 and 1908.

[Drainage area, 1,450 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	46,500	2,870	8,870	6.12	7.06	545,000	A.
February	93,500	3,300	17,400	12.0	12.50	966,000	B.
March	14,700	2,110	4,470	3.08	3.55	275,000	B.
April	46,000	2,480	8,250	5.69	6.35	491,000	B.
May	3,080	1,790	2,280	1.57	1.81	140,000	B.
June	2,670	1,260	1,740	1.20	1.34	104,000	B.
July	1,650	730	958	.661	.76	58,900	C.
August	880	590	670	.462	.53	41,200	C.
September	730	530	578	.399	.45	34,400	C.
October	800	530	574	.396	.46	35,300	C.
November	14,200	530	2,320	1.60	1.78	138,000	C.
December	84,800	1,380	14,000	9.66	11.14	861,000	C.
The year	93,500	530	5,180	3.57	47.73	3,690,000	
1908.							
January	12,000	2,870	6,090	4.20	4.84	374,000	A.
February	6,340	2,670	3,530	2.43	2.62	203,000	A.
March	19,500	2,480	5,630	3.88	4.47	346,000	A.
April	7,080	3,080	4,560	3.14	3.50	271,000	A.
May	7,480	3,300	4,440	3.06	3.53	273,000	A.
June	6,000	3,080	3,900	2.69	3.00	232,000	A.
July	3,080	1,380	1,930	1.33	1.53	119,000	A.
August	1,380	1,050	1,190	.821	.95	73,200	A.
September	1,150	960	1,030	.710	.79	61,300	A.
October	12,000	880	2,410	1.66	1.91	148,000	A.
November	6,700	1,380	2,850	1.97	2.20	170,000	A.
December	9,650	1,510	2,870	1.98	2.28	176,000	A.
The year	19,500	880	3,370	2.32	31.62	2,450,000	

WILLAMETTE RIVER AT ALBANY, OREG.

This station, which was established July 21, 1905, is located at the Corvallis and Eastern Railroad bridge within the city limits of Albany, just below the mouth of Calapooia River and 7 miles above the mouth of Santiam River.

It was established in connection with the general study of the run-off of Willamette River and its tributaries, to develop a rating curve for gage heights of long standing which had been obtained by the United States Weather Bureau. The data will be particularly valuable for the determination of run-off values from forested areas and will be used in the proper design of river improvements for navigation purposes and for development of water power and irrigation. Readings have been obtained at the railroad bridge since the station was established, but it has been found that the Weather Bureau gage is located at a more permanent section and they have therefore been used in preference to those at the Survey gage. The measurements at medium and low stages have been plotted as coordinates with the Weather Bureau observer's reading for the day.

The gage heights at the Weather Bureau gage from 1879 to 1906 have been published in "Daily river stages of the principal rivers of the United States," as follows:

1878–1888, Part III, pp. 46–56.
1892, Part IV, p. 435.
1893–1895, Part V, pp. 36–38.
1896–1899, Part VI, pp. 116–117.
1900–1904, Part VII, pp. 202–204.
1905–6, Part VIII, p. 73.

Discharge measurements of Willamette River at Albany, Oreg., in 1905, 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 20	L. R. Allen	.....	3,720	[a] 1.40	3,430
1906.					
January 6	L. R. Allen	438	5,160	[a] 5.00	13,400
February 8	do	439	4,860	[a] 4.40	11,700
March 28	do	438	4,900	[a] 4.80	13,300
May 9	do	433	4,380	[a] 3.50	9,380
July 25	do	428	3,610	[a] 1.50	4,360
September 5	I. E. Oakes	425	3,580	[a] .80	2,960
1907.					
February 5	I. E. Oakes	2,960	39,600	[b] 27.00	146,000
1908.					
September 26	H. D. McGlashan	434	3,400	[c] .75	2,840

[a] Weather Bureau observer's reading for the day.
[b] Determined from curve of relation of Weather Bureau and Geological Survey gages.
[c] Gage read by hydrographer at time of measurement.

Daily gage height, in feet, of Willamette River at Albany, Oreg., for 1907 and 1908.

[U. S. Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.0	15.3	5.8	5.7	4.0	3.0	2.0	1.1	0.9	0.9	1.1	4.6
2	6.5	16.4	6.7	5.6	3.8	3.0	2.0	1.1	.9	1.0	1.0	4.0
3	6.8	17.8	6.3	5.6	3.7	2.9	2.0	1.1	.8	1.0	.9	3.6
4	14.2	20.4	5.8	5.6	3.6	2.9	2.2	1.1	.8	1.1	1.3	3.3
5	22.2	22.5	5.6	5.2	3.5	2.8	2.0	1.0	.8	1.0	1.2	3.2
6	25.0	30.7	5.2	5.6	3.5	2.8	2.0	1.0	.8	1.0	1.1	3.3
7	17.0	28.2	5.0	10.4	3.4	2.7	2.0	1.0	.8	.9	.9	3.2
8	11.5	23.3	5.0	19.8	3.4	2.7	2.0	1.0	.8	.9	.9	3.2
9	9.2	17.0	5.0	20.0	3.4	2.7	1.8	1.6	.8	.8	.8	4.0
10	7.9	13.0	4.8	16.5	3.4	2.7	1.7	1.5	.8	.7	.8	3.9
11	7.0	11.0	5.6	13.5	3.5	2.6	1.6	1.3	.8	.7	.8	4.4
12	6.3	9.9	5.4	11.8	4.0	2.6	1.6	1.2	.8	.7	.7	5.3
13	6.0	8.8	5.0	10.4	3.9	3.3	1.5	1.1	.8	.7	.7	7.5
14	5.6	8.1	5.0	9.0	3.7	3.3	1.5	1.0	.7	.7	.8	11.4
15	5.0	7.5	4.6	8.8	3.6	3.2	1.5	1.0	.7	.7	.9	12.0
16	4.6	7.0	4.4	8.0	3.4	3.1	1.5	1.0	.8	.7	1.2	9.4
17	4.2	6.6	4.3	7.0	3.3	3.1	1.5	1.0	.8	.7	1.4	7.5
18	4.0	6.4	5.2	6.6	3.4	3.0	1.4	.9	.9	.7	1.2	6.5
19	4.0	5.8	9.1	6.5	3.5	2.9	1.4	.9	1.0	.7	1.0	6.0
20	4.0	5.5	10.0	6.4	3.8	2.7	1.4	.9	.9	.7	1.2	6.2
21	4.0	5.2	11.0	6.4	4.0	2.6	1.4	.8	.9	.7	1.8	7.0
22	4.0	5.0	9.8	6.3	3.8	2.5	1.3	.8	.8	.7	3.5	10.3
23	3.9	5.0	8.7	6.0	3.6	2.4	1.3	.8	.7	.6	3.2	17.0
24	3.9	5.0	8.5	5.8	3.6	2.3	1.3	.8	.7	.6	5.0	22.5
25	3.9	5.0	8.0	5.6	3.4	2.3	1.3	.8	.7	.6	7.5	20.8
26	4.6	5.0	7.5	5.4	3.3	2.3	1.2	.8	.7	.6	10.5	23.4
27	5.0	6.5	6.9	5.2	3.2	2.2	1.2	1.0	.7	.6	8.3	26.2
28	5.6	6.0	6.2	4.8	3.1	2.1	1.2	1.0	.7	.6	6.9	26.5
29	7.7	.....	5.9	5.4	3.0	2.1	1.2	1.0	.7	.6	6.0	20.6
30	12.0	.....	5.8	4.2	3.0	2.1	1.1	.9	.7	.7	5.1	14.8
31	14.2	.....	5.7	.....	3.0	.....	1.1	.9	.....	1.0	.....	11.6
1908.												
1	10.5	4.0	4.2	5.4	4.4	3.7	3.0	1.5	1.3	.7	3.1	3.1
2	10.3	3.9	4.5	5.4	4.5	3.6	3.0	1.5	1.3	.7	3.2	2.9
3	9.6	3.7	4.5	5.3	4.5	3.6	3.0	1.5	1.0	.8	2.8	2.8
4	8.7	3.6	4.4	5.3	4.5	3.6	2.9	1.5	1.0	.8	2.6	2.6
5	8.2	4.0	4.2	5.3	4.4	3.6	2.8	1.5	1.0	.8	2.4	2.4
6	7.0	5.4	4.1	5.0	4.3	3.6	2.7	1.5	1.0	.8	2.2	2.2
7	7.4	6.5	4.0	4.7	4.1	3.5	2.6	1.5	.9	.8	2.0	2.1
8	6.9	7.8	3.8	4.5	4.4	3.5	2.5	1.4	1.0	.8	1.9	2.1
9	7.5	7.2	3.6	4.2	4.6	3.5	2.4	1.3	1.0	.8	1.8	2.1
10	10.0	7.1	3.6	4.1	4.5	3.5	2.3	1.2	1.0	.8	1.7	2.1
11	9.9	6.5	3.6	4.1	4.2	3.5	2.2	1.2	1.0	.8	1.6	2.0
12	8.8	6.1	3.6	4.0	4.1	3.6	2.1	1.1	1.0	.8	1.5	2.0
13	8.0	5.8	3.8	4.3	4.0	3.7	2.0	1.1	1.0	.8	1.5	2.1
14	7.6	5.6	3.8	4.2	3.9	3.8	2.0	1.1	.9	1.0	1.5	2.7
15	7.5	5.2	5.4	4.4	3.8	3.7	2.0	1.1	.9	2.6	1.4	3.0
16	7.5	4.9	10.3	4.3	4.3	3.6	2.0	1.1	.9	2.5	1.4	2.9
17	7.0	5.0	13.3	4.4	5.3	3.5	2.0	1.1	.9	5.1	1.4	2.8
18	6.4	5.2	13.8	4.5	5.5	3.4	1.9	1.0	.9	3.8	1.4	2.6
19	6.0	5.0	11.8	4.9	5.9	3.4	1.9	1.0	.9	3.0	1.6	2.4
20	6.3	4.7	9.4	5.0	6.6	3.4	1.8	1.0	.9	2.6	2.5	2.2
21	8.3	4.4	8.0	5.2	6.7	3.5	1.8	1.0	.8	2.5	5.0	2.1
22	8.2	4.2	7.0	5.2	6.1	4.5	1.7	1.0	.8	2.5	5.8	2.0
23	7.3	4.0	6.3	4.9	5.6	5.0	1.7	1.0	.8	3.0	6.0	2.2
24	6.8	4.0	5.8	4.6	5.1	4.5	1.7	1.0	.8	3.0	6.8	3.9
25	6.1	3.8	5.5	6.0	4.8	4.0	1.6	1.0	.8	2.5	6.5	5.8
26	5.5	3.7	5.4	6.6	4.5	3.7	1.6	1.0	.8	2.4	5.7	5.4
27	5.3	3.6	5.3	5.9	4.2	3.6	1.6	1.0	.8	2.3	5.0	7.6
28	4.8	3.9	5.2	5.3	4.2	3.6	1.5	1.0	.7	2.2	4.4	7.4
29	4.4	4.1	5.1	4.9	4.1	3.4	1.5	1.0	.7	2.2	4.0	7.3
30	4.4	.....	4.9	4.6	3.9	3.1	1.5	1.3	.7	2.1	5.5	8.8
31	4.2	.....	4.8	.....	3.8	.....	1.5	1.4	.....	2.1	.....	7.2

Rating table for Willamette River at Albany, Oreg., for 1878 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	1,870	3.00	7,920	5.80	16,140	11.20	38,610
.30	2,040	3.10	8,170	5.90	16,470	11.40	39,570
.40	2,220	3.20	8,430	6.00	16,800	11.60	40,540
.50	2,400	3.30	8,690	6.20	17,480	11.80	41,520
.60	2,580	3.40	8,950	6.40	18,170	12.00	42,500
.70	2,760	3.50	9,220	6.60	18,870	13.00	47,600
.80	2,950	3.60	9,490	6.80	19,580	14.00	53,000
.90	3,140	3.70	9,760	7.00	20,300	15.00	58,600
1.00	3,330	3.80	10,040	7.20	21,040	16.00	64,500
1.10	3,530	3.90	10,320	7.40	21,800	17.00	70,700
1.20	3,730	4.00	10,600	7.60	22,580	18.00	77,100
1.30	3,940	4.10	10,890	7.80	23,380	19.00	83,700
1.40	4,150	4.20	11,180	8.00	24,200	20.00	90,500
1.50	4,360	4.30	11,470	8.20	25,040	21.00	97,400
1.60	4,580	4.40	11,770	8.40	25,890	22.00	104,600
1.70	4,810	4.50	12,070	8.60	26,750	23.00	112,200
1.80	5,040	4.60	12,370	8.80	27,620	24.00	120,100
1.90	5,270	4.70	12,670	9.00	28,500	25.00	128,400
2.00	5,500	4.80	12,980	9.20	29,380	26.00	137,000
2.10	5,730	4.90	13,290	9.40	30,280	27.00	146,000
2.20	5,970	5.00	13,600	9.60	31,180	28.00	155,500
2.30	6,210	5.10	13,910	9.80	32,080	29.00	165,000
2.40	6,450	5.20	14,220	10.00	33,000	30.00	174,800
2.50	6,690	5.30	14,530	10.20	33,920	31.00	184,700
2.60	6,930	5.40	14,850	10.40	34,840	32.00	195,000
2.70	7,170	5.50	15,170	10.60	35,770	33.00	205,500
2.80	7,420	5.60	15,490	10.80	36,710		
2.90	7,670	5.70	15,810	11.00	37,650		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 8 discharge measurements made during 1906–1908 and is well defined between gage heights 0.7 foot and 5.0 feet and fairly well above gage height 5.0 feet.

Monthly discharge of Willamette River at Albany, Oreg.

[Drainage area, 4,860 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1879.							
January	51,400	3,730	13,600	2.80	3.23	836,000	B.
February	55,800	7,670	28,300	5.82	6.06	1,570,000	B.
March	109,000	21,000	43,000	8.85	10.20	2,640,000	B.
April	36,700	11,200	20,500	4.22	4.71	1,220,000	B.
May	33,500	11,200	18,900	3.89	4.48	1,160,000	B.
June	21,800	6,210	11,000	2.26	2.52	655,000	B.
July	6,210	3,330	4,750	.977	1.13	292,000	B.
August	3,330	2,220	2,710	.558	.64	167,000	C.
September	4,360	1,870	2,310	.475	.53	137,000	C.
October	6,690	3,330	4,560	.938	1.08	280,000	B.
November	37,600	2,950	13,400	2.76	3.08	797,000	B.
December	116,000	8,430	34,000	7.00	8.07	2,090,000	B.
The year	116,000	1,870	16,400	3.38	45.73	11,800,000	
1892.							
January 21–31	17,500	13,600	14,900	3.07	1.26	325,000	A.
February	16,800	9,760	12,500	2.57	2.77	719,000	A.
March	20,700	11,800	14,500	2.98	3.44	892,000	A.
April	26,300	16,100	20,500	4.22	4.71	1,220,000	A.
May	19,900	13,600	16,100	3.31	3.82	990,000	A.
June	13,600	6,690	9,830	2.02	2.25	585,000	A.
November	27,600	2,950	7,360	1.51	1.68	438,000	A.
December	73,200	5,500	18,800	3.87	4.46	1,160,000	A.
The period						6,330,000	

Monthly discharge of Willamette River at Albany, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1893.							
January	33,500	7,170	11,900	2.45	2.82	732,000	A.
February	73,200	6,930	25,500	5.25	5.47	1,420,000	A.
March	26,800	13,600	17,500	3.60	4.15	1,080,000	A.
April	46,600	17,500	26,700	5.49	6.12	1,590,000	A.
May	30,300	14,500	22,700	4.67	5.38	1,400,000	A.
June	15,800	8,690	12,400	2.55	2.84	738,000	A.
July	8,690	4,580	6,380	1.31	1.51	392,000	A.
August	4,580	2,950	3,520	.724	.83	216,000	A.
September	5,730	2,950	3,770	.776	.87	224,000	B.
October	58,600	5,500	16,400	3.37	3.88	1,010,000	A.
November	89,800	6,690	18,700	3.85	4.30	1,110,000	A.
The period						9,910,000	
1894.							
January	157,000	15,500	53,800	11.1	12.80	3,310,000	B.
February	40,500	16,800	25,600	5.27	5.49	1,420,000	A.
March	123,000	24,200	50,500	10.4	11.99	3,110,000	B.
April	42,500	18,500	24,900	5.12	5.71	1,480,000	A.
May	31,600	14,500	20,200	4.16	4.80	1,240,000	A.
June	35,800	12,100	21,000	4.32	4.82	1,250,000	A.
July	11,800	5,500	8,560	1.76	2.03	526,000	A.
August	5,730	4,150	4,870	1.00	1.15	299,000	B.
September	5,040	3,940	4,270	.879	.98	254,000	B.
The period						12,900,000	
1895.							
January	79,700	10,300	32,300	6.65	7.67	1,990,000	B.
February	18,500	7,670	11,500	2.37	2.47	639,000	A.
March	42,500	6,930	15,100	3.11	3.58	928,000	A.
April	26,300	13,600	17,000	3.50	3.90	1,010,000	A.
May	39,100	9,220	16,900	3.48	4.01	1,040,000	A.
June	16,800	5,500	9,050	1.86	2.08	539,000	A.
July	5,500	3,330	4,460	.918	1.06	274,000	B.
August	3,330	2,950	3,050	.628	.72	188,000	B.
September	3,730	2,950	3,220	.663	.74	192,000	B.
October	2,950	2,220	2,710	.558	.64	167,000	B.
November	6,690	2,220	3,230	.665	.74	192,000	B.
December	65,700	5,500	20,000	4.12	4.75	1,230,000	A.
The year	79,700	2,220	11,500	2.38	32.36	8,390,000	
1896.							
January	128,000	15,500	46,100	9.49	10.94	2,830,000	B.
February	47,600	11,200	18,300	3.77	4.07	1,050,000	A.
March	60,900	15,500	27,300	5.62	6.48	1,680,000	A.
April	96,000	14,800	28,900	5.95	6.64	1,720,000	A.
May	60,900	17,800	28,900	5.95	6.86	1,780,000	A.
June	22,200	12,100	15,000	3.09	3.45	893,000	A.
July	11,800	5,040	7,590	1.56	1.80	467,000	A.
August	5,040	3,330	3,910	.805	.93	240,000	B.
September	4,810	3,330	3,570	.735	.82	212,000	B.
October	3,940	2,950	3,180	.654	.75	196,000	B.
November	160,000	6,690	42,000	8.64	9.64	2,500,000	B.
December	77,100	14,200	30,500	6.28	7.24	1,880,000	A.
The year	160,000	2,950	21,300	4.38	59.62	15,400,000	
1897.							
January	36,700	11,200	17,400	3.58	4.13	1,070,000	A.
February	79,700	13,600	36,400	7.49	7.80	2,020,000	B.
March	73,900	14,500	26,000	5.35	6.17	1,600,000	A.
April	38,600	16,800	28,900	5.95	6.64	1,720,000	A.
May	16,800	10,000	14,000	2.88	3.32	861,000	A.
June	11,500	6,930	8,400	1.73	1.93	500,000	A.
July	8,950	3,940	6,130	1.26	1.45	377,000	A.
August	3,940	3,330	3,620	.745	.86	223,000	B.
September	4,360	3,330	3,760	.774	.86	224,000	B.
October	6,690	3,330	3,830	.788	.91	236,000	B.
November	54,100	3,330	17,500	3.60	4.02	1,040,000	A.
December	73,900	16,800	36,700	7.55	8.70	2,260,000	B.
The year	79,700	3,330	16,900	3.47	46.79	12,100,000	

Monthly discharge of Willamette River at Albany, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1898.							
January	27,600	10,600	16,200	3.33	3.84	996,000	A.
February	34,400	10,600	20,600	4.24	4.42	1,140,000	A.
March	15,200	9,220	11,400	2.35	2.71	701,000	A.
April	15,200	10,000	12,400	2.55	2.84	738,000	A.
May	10,600	7,420	8,360	1.72	1.98	514,000	A.
June	12,100	5,500	7,910	1.63	1.82	471,000	A.
July	5,500	3,330	4,100	.844	.97	252,000	B.
August	3,330	2,760	2,970	.611	.70	183,000	B.
September	4,360	2,760	3,040	.626	.70	181,000	B.
October	5,500	3,330	3,500	.720	.83	215,000	B.
November	67,000	3,330	16,900	3.48	3.88	1,010,000	A.
December	55,800	9,220	20,500	4.22	4.86	1,260,000	A.
The year	67,000	2,760	10,700	2.19	29.53	7,660,000	
1899.							
January	68,200	16,800	33,100	6.81	7.85	2,040,000	B.
February	79,700	10,900	28,200	5.80	6.04	1,570,000	A.
March	112,000	22,200	37,400	7.70	8.88	2,300,000	B.
April	30,700	14,200	21,100	4.34	4.84	1,260,000	A.
May	25,900	14,200	19,400	3.99	4.60	1,190,000	A.
June	24,200	13,600	18,900	3.89	4.34	1,120,000	A.
July	13,600	5,970	10,200	2.10	2.42	627,000	A.
August	7,920	5,040	5,770	1.19	1.37	355,000	A.
September	6,690	4,150	5,260	1.08	1.20	313,000	A.
October	40,000	3,730	9,210	1.90	2.19	566,000	A.
November	58,000	6,930	14,000	2.88	3.21	833,000	A.
December	98,800	15,200	34,000	7.00	8.07	2,090,000	B.
The year	112,000	3,730	19,700	4.06	55.01	14,300,000	
1900.							
January	120,000	16,500	35,900	7.39	8.52	2,210,000	B.
February	68,800	14,200	23,300	4.79	4.99	1,290,000	A.
March	40,000	14,200	21,400	4.40	5.07	1,320,000	A.
April	33,900	10,600	15,900	3.27	3.65	946,000	A.
May	11,500	7,920	9,940	2.05	2.36	611,000	A.
June	8,690	5,500	6,820	1.40	1.56	406,000	A.
July	6,450	4,150	4,760	.979	1.13	293,000	A.
August	4,150	2,760	3,330	.685	.79	205,000	A.
September	3,330	2,580	3,010	.619	.69	179,000	A.
October	12,400	2,760	5,560	1.14	1.31	342,000	A.
November	33,000	6,690	14,000	2.88	3.21	833,000	A.
December	80,400	7,920	22,600	4.65	5.36	1,390,000	A.
The year	120,000	2,580	13,900	2.85	38.74	10,000,000	
1901.							
January	179,000	15,500	39,900	8.21	9.46	2,450,000	B.
February	137,000	8,430	33,300	6.85	7.13	1,850,000	B.
March	53,000	13,900	24,300	5.00	5.76	1,490,000	A.
April	29,400	10,600	18,100	3.72	4.15	1,080,000	A.
May	13,900	10,600	12,500	2.57	2.96	769,000	A.
June	10,600	5,270	7,450	1.53	1.71	443,000	A.
July	5,270	3,940	4,640	.955	1.10	285,000	A.
August	3,940	2,950	3,070	.632	.73	189,000	A.
September	6,930	2,950	3,860	.794	.89	230,000	A.
October	5,970	3,330	3,860	.794	.92	237,000	A.
November	30,300	3,330	7,680	1.58	1.76	457,000	A.
December	79,700	10,300	26,000	5.35	6.17	1,600,000	A.
The year	179,000	2,950	15,400	3.17	42.74	11,100,000	
1902.							
January	33,900	7,420	13,800	2.84	3.27	848,000	A.
February	70,700	7,920	30,200	6.21	6.47	1,680,000	A.
March	49,700	17,500	26,100	5.37	6.19	1,600,000	A.
April	43,500	12,100	21,300	4.38	4.89	1,270,000	A.
May	24,200	12,100	18,000	3.70	4.27	1,110,000	A.
June	15,500	6,690	10,400	2.14	2.39	619,000	A.
July	17,500	4,360	9,970	2.05	2.36	613,000	A.
August	4,360	3,330	3,860	.794	.92	237,000	A.
September	3,330	2,950	3,060	.630	.70	182,000	A.
October	3,330	2,950	3,210	.660	.76	197,000	A.
November	53,000	3,330	17,500	3.60	4.02	1,040,000	A.
December	124,000	15,500	41,000	8.44	9.73	2,520,000	B.
The year	124,000	2,950	16,500	3.40	45.97	11,900,000	

Monthly discharge of Willamette River at Albany, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1903.							
January	188,000	10,300	42,200	8.68	10.01	2,590,000	B.
February	52,400	14,200	23,400	4.81	5.01	1,300,000	A.
March	33,000	12,100	16,100	3.31	3.82	990,000	A.
April	19,200	8,690	12,000	2.47	2.76	714,000	A.
May	12,400	9,760	11,400	2.35	2.71	701,000	A.
June	12,700	6,450	8,790	1.81	2.02	523,000	A.
July	6,690	4,150	5,240	1.08	1.24	322,000	A.
August	4,580	3,330	3,800	.782	.90	234,000	A.
September	6,690	3,330	4,520	.930	1.04	269,000	A.
October	8,170	3,330	4,430	.912	1.05	272,000	A.
November	55,800	3,330	23,900	4.92	5.49	1,420,000	A.
December	17,500	9,490	13,200	2.72	3.14	812,000	A.
The year	188,000	3,330	14,100	2.90	39.19	10,100,000	
1904.							
January	62,100	11,200	25,500	5.25	6.05	1,570,000	A.
February	124,000	13,300	44,000	9.05	9.76	2,530,000	B.
March	97,400	30,700	51,000	10.5	12.11	3,140,000	B.
April	40,000	17,500	26,700	5.49	6.12	1,590,000	A.
May	24,200	13,000	16,600	3.42	3.94	1,020,000	A.
June	13,000	6,690	9,400	1.93	2.15	559,000	A.
July	6,690	4,580	5,600	1.15	1.33	344,000	A.
August	4,580	3,530	3,880	.798	.92	239,000	A.
September	3,330	3,330	3,330	.685	.76	198,000	A.
October	5,970	3,140	3,770	.776	.89	232,000	A.
November	8,430	3,140	4,960	1.02	1.14	295,000	A.
December	69,400	5,040	16,400	3.37	3.88	1,010,000	A.
The year	124,000	3,140	17,600	3.62	49.05	12,700,000	
1905.							
January	69,400	10,000	20,100	4.14	4.77	1,240,000	A.
February	16,100	7,670	11,200	2.30	2.40	622,000	A.
March	47,600	6,450	15,500	3.19	3.68	953,000	A.
April	21,800	7,420	12,500	2.57	2.87	744,000	A.
May	12,400	6,210	8,990	1.85	2.13	553,000	A.
June	10,600	5,040	7,000	1.44	1.61	417,000	A.
July	5,040	2,950	3,850	.792	.91	237,000	B.
August	2,950	2,400	2,720	.560	.65	167,000	A.
September	3,330	2,400	2,520	.519	.58	150,000	A.
October	8,430	3,330	5,290	1.09	1.26	325,000	A.
November	9,220	3,330	4,990	1.03	1.15	297,000	A.
December	19,600	7,420	11,900	2.45	2.82	732,000	A.
The year	69,400	2,400	8,880	1.83	24.83	6,440,000	
1906.							
January	54,100	13,600	24,100	4.96	5.72	1,480,000	A.
February	56,300	8,430	22,000	4.53	4.72	1,220,000	A.
March	39,600	10,000	16,000	3.29	3.79	984,000	A.
April	20,300	9,220	12,000	2.47	2.76	714,000	A.
May	27,600	8,430	11,300	2.33	2.69	695,000	A.
June	18,900	7,920	13,000	2.67	2.98	774,000	A.
July	7,920	4,150	5,400	1.11	1.28	332,000	A.
August	4,150	2,950	3,300	.679	.78	203,000	A.
September	5,040	2,760	3,210	.660	.74	191,000	A.
October	7,920	2,580	3,980	.819	.94	245,000	A.
November	44,000	3,730	18,200	3.74	4.17	1,080,000	A.
December	33,000	7,170	18,100	3.72	4.29	1,110,000	A.
The year	56,300	2,580	12,500	2.58	34.86	9,030,000	
1907.							
January	128,000	10,300	27,800	5.72	6.60	1,710,000	A.
February	182,000	13,600	47,400	9.75	10.15	2,630,000	B.
March	37,600	11,500	18,600	3.83	4.42	1,140,000	A.
April	90,500	11,200	27,000	5.56	6.20	1,610,000	A.
May	10,600	7,920	9,250	1.90	2.19	569,000	A.
June	8,690	5,730	7,180	1.48	1.65	427,000	A.
July	5,970	3,530	4,500	.926	1.07	277,000	A.
August	4,580	2,950	3,360	.691	.80	207,000	A.
September	3,330	2,760	2,930	.603	.67	174,000	A.
October	3,530	2,580	2,880	.593	.68	177,000	A.
November	35,300	2,760	7,880	1.62	1.81	469,000	A.
December	142,000	8,430	40,300	8.29	9.56	2,480,000	B.
The year	182,000	2,580	16,600	3.41	45.80	11,900,000	

Monthly discharge of Willamette River at Albany, Oreg.—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	35,300	11,200	22,000	4.53	5.22	1,350,000	A.
February	23,400	9,490	13,500	2.78	3.00	776,000	A.
March	51,900	9,490	17,700	3.64	4.20	1,090,000	A.
April	18,900	10,600	13,300	2.74	3.06	791,000	A.
May	19,200	10,000	12,700	2.61	3.01	781,000	A.
June	13,600	8,170	9,710	2.00	2.23	578,000	A.
July	7,920	4,360	5,730	1.18	1.36	352,000	A.
August	4,360	3,330	3,720	.765	.88	229,000	A.
September	3,940	2,760	3,170	.652	.73	189,000	A.
October	13,900	2,760	5,340	1.10	1.27	328,000	A.
November	19,600	4,150	8,700	1.79	2.00	518,000	A.
December	27,600	5,500	9,830	2.02	2.33	604,000	A.
The year	51,900	2,760	10,400	2.15	29.29	7,590,000	

COAST FORK OF WILLAMETTE RIVER NEAR GOSHEN, OREG.

This station was established August 23, 1905, and has been maintained continuously since that date. It is located at a highway bridge 3 miles east of Goshen and 4 miles above the mouth of Coast Fork. The records are of value in a general study of run-off conditions in the Willamette Valley. If storage could be supplied the stream would be valuable for both water-power and irrigation development. Gages have washed out at times, but they have been replaced at the same datum and no material inaccuracy in the records has been caused on this account.

Discharge measurements of Coast Fork of Willamette River near Goshen, Oreg., in 1907, 1908, and 1909.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 31	I. E. Oakes	256	1,870	7.75	10,700
March 8	do	244	598	2.50	1,440
August 14	J. C. Stevens	140	149	.35	105
December 23	C. E. Ellsworth	270	2,040	8.10	9,500
1908.					
March 18	P. A. Cupper	238	1,150	5.25	4,870
September 22	H. D. McGlashan	144	95	.39	63
1909.					
January 18	H. D. McGlashan	266	2,400	10.02	14,800

Daily gage height, in feet, of Coast Fork of Willamette River near Goshen, Oreg., for 1907 and 1908.

[John D. West, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.9	9.2	3.6	3.7	1.7	0.8	0.8	0.4	0.4	1.0	0.7	2.0
2	2.8	8.9	3.6	3.4	1.7	.8	.8	.4	.4	1.0	.9	1.7
3	5.0	10.8	3.2	3.2	1.7	.8	.8	.4	.3	.9	1.3	1.7
4	14.8	13.0	3.2	2.9	1.4	.8	.8	.4	.3	.8	1.3	1.6
5	8.9	13.8	2.7	3.2	1.2	.8	.7	.4	.3	.8	1.2	1.7
6	6.1	10.0	2.5	6.3	1.2	.8	.7	.4	.3	.5	.9	1.5
7	5.0	7.2	2.5	14.0	1.1	.8	.7	.4	.3	.7	.9	1.3
8	4.1	5.6	2.3	8.6	1.1	.8	.7	.8	.4	.6	.9	1.5
9	3.7	5.0	2.1	6.4	1.1	.8	.7	.9	.4	.6	.9	1.7
10	3.4	4.2	2.3	6.0	1.1	.8	.7	.9	.3	.5	.9	2.0
11	3.1	3.9	2.2	5.7	1.1	.9	.6	.9	.3	.5	.8	2.6
12	3.1	3.5	2.2	5.6	1.2	1.4	.6	.8	.3	.5	.8	3.1
13	2.9	3.2	2.1	4.4	1.2	1.4	.6	.6	.3	.5	.8	8.8
14	2.9	2.9	2.1	3.9	1.1	1.7	.6	.6	.3	.5	.8	6.4
15	2.5	2.6	2.1	3.5	1.1	1.6	.6	.6	.3	.5	.9	5.5
16	2.4	2.5	2.2	3.1	1.1	1.6	.6	.5	.8	.5	1.0	5.0
17	2.4	2.5	3.5	2.9	1.0	1.6	.5	.5	.8	.4	1.5	4.7
18	2.6	2.3	7.6	2.5	1.0	1.6	.5	.5	.7	.4	1.7	4.6
19	2.5	2.2	5.7	2.5	1.0	1.5	.5	.5	.7	.4	1.9	4.3
20	2.5	2.2	7.6	2.5	1.0	1.3	.5	.5	.7	.4	2.0	4.3
21	2.3	2.1	5.7	2.5	1.0	1.0	.5	.4	.7	.4	2.5	4.0
22	2.1	2.1	5.0	2.4	1.2	1.0	.5	.4	.6	.4	3.0	11.0
23	2.1	2.4	5.0	2.3	1.2	1.0	.5	.4	.6	.3	3.6	13.0
24	3.1	2.5	4.7	2.3	1.3	1.0	.5	.4	.5	.3	3.5	10.5
25	3.5	3.4	4.4	2.3	1.3	1.0	.5	.8	.4	.3	5.3	11.0
26	3.6	3.5	4.0	2.1	1.2	1.0	.4	.8	.4	.3	4.7	14.1
27	3.9	2.7	3.6	2.1	1.2	.9	.4	.7	.4	.3	4.0	10.0
28	5.6	2.7	3.5	2.0	1.1	.9	.4	.5	.3	.3	3.6	7.2
29	8.7	.....	3.5	2.0	1.1	.9	.4	.4	.6	.4	3.0	6.8
30	7.7	.....	3.4	1.9	.9	.8	.4	.4	.8	.6	2.2	6.6
31	7.5	.....	3.6	.....	.8	.....	.4	.4	.....	.7	.....	6.0
1908.												
1	5.8	2.5	2.3	3.3	2.4	2.3	2.45	.7	.8	.55	1.45	1.35
2	5.6	2.3	2.0	3.2	2.4	2.3	2.4	.7	.7	.65	1.35	1.35
3	4.8	2.0	2.0	3.0	2.2	2.8	2.4	.65	.7	.65	1.25	1.25
4	4.2	2.7	1.9	3.3	2.0	2.7	2.3	.65	.7	.65	1.15	1.25
5	4.0	3.0	1.9	3.0	2.0	2.5	2.0	.65	.7	.55	1.15	1.25
6	4.0	3.6	1.7	2.6	2.3	2.5	1.7	.65	.8	.55	.85	1.25
7	3.7	5.0	1.5	2.5	2.4	2.3	1.6	.65	.8	.55	.85	1.25
8	3.9	4.3	2.4	2.4	2.25	2.25	1.35	.6	.7	.35	.95	1.25
9	6.8	4.3	2.5	2.3	2.2	2.2	1.0	.6	.55	.35	.85	1.25
10	5.0	4.2	2.6	2.1	1.7	2.2	.9	.8	.65	.35	.85	1.25
11	4.6	4.0	2.55	2.0	1.65	2.0	.9	.8	.55	.25	.85	1.2
12	4.6	3.8	2.55	2.3	2.0	1.85	.9	.9	.55	.25	.85	1.15
13	4.5	3.8	2.5	2.3	2.1	1.6	.8	.9	.55	.45	.85	1.35
14	4.3	3.8	2.5	2.3	2.2	1.6	.8	.8	.55	1.05	.85	1.65
15	4.3	3.6	3.1	2.2	2.4	1.7	.8	.8	.55	5.25	.75	1.55
16	4.1	3.6	4.4	2.2	2.5	1.75	.8	.8	.45	4.0	.75	1.55
17	4.1	3.4	5.4	2.1	3.2	1.9	.8	.8	.45	1.85	.75	1.35
18	3.7	3.3	5.3	2.0	3.9	2.2	.8	.8	.45	1.75	.75	1.35
19	3.5	3.3	4.4	2.0	4.2	2.4	.8	.7	.4	1.75	1.85	1.25
20	3.5	3.0	3.4	2.0	4.7	2.4	.75	.7	.45	1.65	1.75	1.25
21	3.3	3.0	3.3	1.9	4.5	2.9	.75	.65	.45	1.65	4.4	1.25
22	3.2	3.0	2.8	2.3	4.3	3.5	.7	.65	.35	1.35	3.3	1.35
23	3.2	2.9	2.6	2.5	3.6	3.5	.7	.65	.35	1.35	4.0	1.55
24	3.0	2.9	2.4	3.5	3.4	3.3	.7	.6	.35	1.35	4.2	4.0
25	3.0	2.7	2.6	3.3	3.0	3.0	.7	.6	.35	1.35	3.5	3.2
26	2.9	2.5	2.35	3.0	2.8	3.0	.7	.6	.35	1.45	3.0	5.2
27	2.7	2.4	2.5	2.7	2.8	2.7	.75	.6	.35	1.25	1.85	4.2
28	2.7	2.3	2.5	2.6	2.7	2.6	.75	.6	.35	1.25	1.55	4.0
29	2.6	2.3	2.5	2.6	2.5	2.6	.75	.55	.25	1.05	1.35	5.0
30	2.6	.....	2.5	2.4	2.5	2.5	.7	.8	.25	1.15	1.35	4.1
31	2.5	.....	3.2	.....	2.5	.....	.7	.8	.....	1.35	.....	3.5

Rating tables for Coast Fork of Willamette River near Goshen, Oreg.

JANUARY 1 TO DECEMBER 23, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	93	1.90	917	3.50	2,590	6.20	6,910
.40	115	2.00	995	3.60	2,730	6.40	7,270
.50	140	2.10	1,075	3.70	2,870	6.60	7,650
.60	168	2.20	1,160	3.80	3,010	6.80	8,030
.70	200	2.30	1,250	3.90	3,150	7.00	8,410
.80	235	2.40	1,350	4.00	3,290	8.00	10,400
.90	275	2.50	1,450	4.20	3,570	9.00	12,500
1.00	325	2.60	1,550	4.40	3,850	10.00	14,760
1.10	375	2.70	1,650	4.60	4,150	11.00	17,160
1.20	435	2.80	1,760	4.80	4,470	12.00	19,700
1.30	495	2.90	1,870	5.00	4,800	13.00	22,400
1.40	557	3.00	1,980	5.20	5,140	14.00	25,300
1.50	620	3.10	2,090	5.40	5,480	15.00	28,300
1.60	690	3.20	2,200	5.60	5,830		
1.70	765	3.30	2,320	5.80	6,190		
1.80	840	3.40	2,450	6.00	6,550		

DECEMBER 24, 1907, TO DECEMBER 31, 1908.[b]

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	27	0.70	172
.30	44	.80	220
.40	65	.90	270
.50	95	1.00	320
.60	130	1.10	375

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on six discharge measurements made during 1907–1909 and is fairly well defined below gage height 10.0 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1908 and is fairly well defined above gage height 0.40 foot. Above gage height 1.1 feet it is the same as the 1907 table.

Monthly discharge of Coast Fork of Willamette River near Goshen, Oreg., for 1907 and 1908.

[Drainage area, 690 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	27,700	1,080	4,390	6.36	7.33	270,000	B.
February	24,700	1,080	5,640	8.17	8.51	313,000	B.
March	9,600	1,080	2,990	4.33	4.99	184,000	B.
April	25,300	917	3,700	5.36	5.98	220,000	B.
May	765	235	426	.617	.71	26,200	B.
June	765	235	380	.551	.61	22,600	B.
July	235	115	164	.238	.27	10,100	B.
August	275	115	159	.230	.27	9,780	B.
September	235	93	136	.197	.22	8,090	B.
October	325	93	154	.223	.26	9,470	B.
November	5,310	200	1,190	1.72	1.92	70,800	B.
December	25,600	495	6,590	9.55	11.01	405,000	B.
The year	27,700	93	2,160	3.13	42.08	1,550,000	
1908.							
January	8,030	1,450	3,240	4.70	5.42	199,000	B.
February	4,800	995	2,320	3.36	3.62	133,000	B.
March	5,480	620	1,860	2.70	3.11	114,000	B.
April	2,590	917	1,510	2.19	2.44	89,800	B.
May	4,310	728	1,800	2.61	3.01	111,000	B.
June	2,590	690	1,420	2.06	2.30	84,500	B.
July	1,400	172	425	.616	.71	26,100	B.
August	270	112	175	.254	.29	10,800	B.
September	220	36	109	.158	.18	6,490	B.
October	5,220	36	610	.884	1.02	37,500	B.
November	3,850	196	910	1.32	1.47	54,100	B.
December	5,140	405	1,290	1.87	2.16	79,300	B.
The year	8,030	36	1,310	1.89	25.73	946,000	

M'KENZIE RIVER NEAR SPRINGFIELD, OREG.

This station was established September 12, 1905, and has been maintained continuously since that date. It is located at Hendricks Ferry—an old river crossing that has recently been replaced by a highway bridge—3 miles below Waterville, 4 miles above Thurston, and 3 miles above the mouth of Camp Creek.

The results obtained at this station have considerable economic value, as it is probable that this river will be extensively used for both irrigation and water power. The station also furnishes data for determining run-off factors from heavily forested areas with high rainfall.

The conditions at this station do not favor accurate results. The stream is extensively used for floating logs during all seasons of the year, and the gage records have been greatly influenced thereby. Individual daily records may be greatly in error, although it is probable that this error diminishes rapidly as records of longer periods are considered. The measurements taken during high water are not very reliable. The water is too swift to make soundings possible, and depths are necessarily estimated from previous measurements at a lower stage, but as the gage is located about 200 feet above the point of measurement, the height of water surface at the cable can not be determined accurately. Since the establishment of the station a highway bridge has been built between the gage and the cable, and whatever relation may have existed between the height of the water surface at the gage and at the cable has been disturbed by the piers of this bridge, which have caused bars to form below them. Individual measurements of low and medium stages can be made with accuracy and are reliable.

Discharge measurements of McKenzie River near Springfield, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 15	J. C. Stevens	312	1,230	1.78	2,170
December 19	C. E. Ellsworth	409	1,630	2.95	5,460
December 23	do	426	3,100	6.92	23,600
1908.					
March 17	P. A. Cupper	420	2,990	5.82	13,800
March 19	do	405	2,380	4.20	9,160
September 22	H. D. McGlashan	372	1,490	[a] 1.42	1,940
October 9	do	343	1,260	.90	1,820

[a] Gage height affected by running of logs.

Daily gage height, in feet, of McKenzie River near Springfield, Oreg., for 1907 and 1908.

[Grant Hendricks and Mrs. N. M. Hendricks, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.85	6.05	3.3	3.2	3.0	2.8	2.25	1.8	1.75	1.65	1.65	2.9
2	4.4	6.4	3.3	3.15	3.0	2.75	2.25	1.8	1.75	1.65	1.65	2.8
3	6.85	9.6	3.3	3.25	3.0	2.75	2.2	1.8	1.75	1.65	1.7	2.7
4	6.45	11.5	3.3	3.15	3.0	2.75	2.2	1.8	1.7	1.65	1.8	2.55
5	5.45	11.75	3.25	3.25	3.0	2.8	2.2	1.8	1.7	1.65	1.6	2.4
6	4.3	8.3	3.25	3.7	3.0	2.8	2.15	1.8	1.7	1.65	1.55	2.45
7	3.15	6.4	3.25	7.5	3.0	2.9	2.15	1.8	1.7	1.6	1.55	2.5
8	4.1	5.3	3.2	6.6	3.0	2.5	2.1	2.0	1.7	1.6	1.55	2.7
9	2.9	5.0	3.15	5.1	3.0	2.8	2.1	2.0	1.7	1.6	1.5	2.8
10	2.8	4.8	3.1	5.1	3.2	2.9	2.1	1.9	1.7	1.6	1.65	2.9
11	2.7	4.65	3.0	4.6	3.2	2.85	2.05	1.85	1.65	1.55	1.7	3.4
12	2.55	4.5	3.0	4.55	3.2	2.85	2.05	1.85	1.65	1.55	1.85	3.45
13	2.4	4.35	3.0	4.35	3.1	2.8	2.0	1.8	1.65	1.55	2.0	5.3
14	2.35	4.2	2.9	4.2	3.0	2.8	2.0	1.8	1.65	1.55	1.85	4.7
15	2.25	4.05	2.9	4.0	3.0	2.7	2.0	1.8	1.65	1.6	1.8	4.2
16	2.25	3.8	2.8	3.85	3.0	2.6	2.0	1.75	1.65	1.6	1.8	3.45
17	2.15	3.7	3.9	3.65	3.0	2.6	1.95	1.75	1.65	1.6	1.75	3.2
18	2.1	3.6	3.6	4.05	3.0	2.4	1.95	1.75	1.6	1.65	1.7	3.0
19	2.1	3.55	4.0	4.0	3.25	2.4	1.95	1.75	1.6	1.65	2.05	2.95
20	2.05	3.4	3.8	4.1	3.2	2.45	1.9	1.75	1.6	1.65	2.3	3.8
21	2.05	3.35	3.5	3.9	3.2	2.45	1.9	1.75	1.6	1.7	2.7	4.45
22	2.05	3.35	3.4	3.85	3.3	2.5	1.9	1.75	1.65	1.7	2.9	8.75
23	2.05	3.35	3.3	3.65	3.1	2.45	1.9	1.8	1.65	1.75	3.0	7.2
24	2.1	3.35	3.2	3.65	3.0	2.4	1.9	1.8	1.65	1.8	6.5	7.3
25	2.25	3.40	3.15	3.6	3.0	2.35	1.9	1.85	1.65	1.9	4.5	8.3
26	2.35	3.55	3.2	3.5	2.95	2.35	1.85	1.85	1.65	2.1	4.2	9.1
27	2.55	3.45	3.2	3.3	2.95	2.3	1.85	1.8	1.65	2.1	3.7	7.3
28	4.1	3.35	3.2	3.2	2.9	2.3	1.85	1.75	1.65	1.7	3.3	5.3
29	5.45	.....	3.2	3.1	2.9	2.25	1.85	1.75	1.7	1.7	3.1	4.6
30	5.45	.....	3.25	3.05	2.85	2.25	1.85	1.75	1.7	1.65	3.0	4.2
31	5.6	.....	3.2	.....	2.85	.....	1.85	1.75	.....	1.65	.....	4.0
1908.												
1	3.8	2.4	2.35	2.95	3.05	2.45	2.1	1.4	1.2	.95	2.0	1.8
2	3.6	2.45	2.35	2.95	3.0	2.5	2.1	1.35	1.15	.95	1.8	1.7
3	3.45	2.5	2.25	2.9	3.0	2.5	2.1	1.3	1.15	.95	1.75	1.7
4	3.4	2.6	2.25	2.9	2.9	2.5	2.0	1.3	1.15	.95	1.6	1.65
5	3.35	3.2	2.2	2.9	2.8	2.4	1.9	1.3	1.1	.95	1.5	1.6
6	3.3	3.2	2.2	2.75	2.85	2.4	1.85	1.3	1.1	.95	1.5	1.55
7	3.3	3.0	2.2	2.6	3.2	2.4	1.8	1.3	1.15	.95	1.4	1.5
8	3.25	2.9	2.05	2.6	3.0	2.55	1.8	1.3	1.1	.95	1.35	1.5
9	4.1	2.9	2.1	2.7	3.0	2.7	1.8	1.25	1.1	.9	1.35	1.5
10	3.7	2.8	2.2	2.8	2.8	2.8	1.7	1.25	1.15	.9	1.3	1.45
11	3.5	2.7	2.2	2.85	2.8	2.8	1.7	1.25	1.2	1.0	1.3	1.4
12	3.45	2.6	2.2	2.9	2.75	2.8	1.8	1.25	1.2	1.0	1.25	1.45
13	3.4	2.55	2.2	2.9	2.7	2.6	1.8	1.3	1.2	1.3	1.25	1.9
14	3.4	2.5	2.2	3.0	2.6	2.5	1.8	1.25	1.25	3.0	1.25	1.75
15	3.3	2.5	6.3	3.15	2.9	2.5	1.75	1.25	1.3	3.4	1.25	1.6
16	3.3	2.6	7.18	3.25	3.2	2.4	1.5	1.25	1.35	2.7	1.2	1.6
17	3.0	2.55	5.75	3.35	3.15	2.3	1.45	1.25	1.35	2.1	1.15	1.5
18	2.9	2.5	4.65	3.45	3.3	2.35	1.4	1.25	1.4	1.75	1.6	1.5
19	3.2	2.5	4.2	3.5	3.5	2.4	1.4	1.25	1.4	1.9	1.55	1.4
20	3.9	2.4	3.7	3.4	3.5	2.5	1.4	1.2	1.4	1.9	2.8	1.4
21	3.55	2.35	3.55	3.25	3.3	2.9	1.4	1.2	1.45	1.8	2.95	1.45
22	3.3	2.3	3.4	3.1	3.2	3.0	1.4	1.2	1.5	1.8	3.7	1.6
23	3.1	2.25	3.25	3.1	3.1	2.6	1.5	1.2	1.5	1.7	3.5	2.7
24	2.9	2.2	3.1	4.5	3.0	2.5	1.5	1.15	1.0	1.7	3.2	1.5
25	2.85	2.2	3.05	3.8	2.9	2.45	1.5	1.15	1.0	1.65	2.8	2.2
26	2.75	2.25	3.0	3.4	2.9	2.4	1.45	1.15	.95	1.65	2.4	3.0
27	2.7	2.25	2.9	3.25	2.7	2.4	1.4	1.15	.95	1.6	2.3	2.7
28	2.6	2.35	2.9	3.1	2.65	2.3	1.4	1.25	.95	1.55	2.1	4.0
29	2.55	2.35	2.85	3.0	2.6	2.2	1.4	1.5	.95	1.55	2.0	3.7
30	2.45	.....	2.9	3.05	2.6	2.1	1.4	1.3	.95	2.0	1.9	3.5
31	2.4	.....	2.95	.....	2.50	.....	1.4	1.25	.....	2.0	.....	2.75

NOTE.—Gage heights affected by log jams June 5 to 7 and October 23 to 27, 1907; June 9 to 12 and September 10 to 23, 1908; and possibly at other times.

Rating tables for McKenzie River near Springfield, Oreg.

1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	1,630	2.30	3,420	3.10	5,580	3.90	8,000
1.60	1,830	2.40	3,680	3.20	5,870	4.00	8,310
1.70	2,040	2.50	3,940	3.30	6,160	4.10	8,620
1.80	2,250	2.60	4,210	3.40	6,460	4.20	8,940
1.90	2,470	2.70	4,480	3.50	6,760	4.30	9,260
2.00	2,700	2.80	4,750	3.60	7,070	4.40	9,580
2.10	2,930	2.90	5,020	3.70	7,380	4.50	9,900
2.20	3,170	3.00	5,300	3.80	7,690		

1908.[b]

0.90	1,820	2.30	4,080	3.70	7,480	6.20	15,620
1.00	1,930	2.40	4,280	3.80	7,770	6.40	16,340
1.10	2,050	2.50	4,500	3.90	8,060	6.60	17,060
1.20	2,180	2.60	4,720	4.00	8,350	6.80	17,780
1.30	2,310	2.70	4,940	4.20	8,960	7.00	18,500
1.40	2,450	2.80	5,160	4.40	9,580	8.00	22,500
1.50	2,600	2.90	5,380	4.60	10,220	9.00	26,500
1.60	2,770	3.00	5,600	4.80	10,860	10.00	30,500
1.70	2,940	3.10	5,840	5.00	11,500	11.00	34,500
1.80	3,120	3.20	6,080	5.20	12,160	12.00	39,000
1.90	3,300	3.30	6,340	5.40	12,820	13.00	43,500
2.00	3,480	3.40	6,620	5.60	13,500		
2.10	3,680	3.50	6,900	5.80	14,200		
2.20	3,880	3.60	7,190	6.00	14,900		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1907–8, and is fairly well defined between gage heights 1.7 feet and 6.0 feet. Above gage height 4.5 feet it is the same as the 1908 table.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1908, and some earlier measurements, and is fairly well defined between gage heights 2.0 feet and 6.0 feet.

Monthly discharge of McKenzie River near Springfield, Oreg., for 1907 and 1908.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	18,000	2,820	6,450	6.72	7.75	397,000	B.
February	37,900	6,310	12,300	12.8	13.33	683,000	B.
March	8,310	4,750	6,060	6.31	7.28	373,000	B.
April	20,500	5,440	8,420	8.77	9.78	501,000	B.
May	6,160	4,880	5,410	5.64	6.50	333,000	B.
June	5,020	3,300	4,140	4.31	4.81	246,000	B.
July	3,300	2,360	2,710	2.82	3.25	167,000	B.
August	2,700	2,140	2,260	2.35	2.71	139,000	B.
September	2,140	1,830	1,980	2.06	2.30	118,000	B.
October	2,040	1,730	1,920	2.00	2.31	118,000	C.
November	16,700	1,630	3,930	4.09	4.56	234,000	B.
December	26,900	3,680	9,810	10.2	11.76	603,000	B.
The year	37,900	1,630	5,450	5.67	76.34	3,910,000	
1908.							
January	8,650	4,280	6,210	6.47	7.46	382,000	B.
February	6,080	3,880	4,610	4.80	5.18	265,000	B.
March	19,200	3,580	6,280	6.54	7.54	386,000	B.
April	9,900	4,720	5,930	6.18	6.90	353,000	B.
May	6,900	4,500	5,510	5.74	6.62	339,000	B.
June	5,600	3,680	4,460	4.65	5.19	265,000	B.
July	3,680	2,450	2,860	2.98	3.44	176,000	C.
August	2,600	2,120	2,260	2.35	2.71	139,000	C.
September	2,180	1,880	2,000	2.08	2.32	119,000	C.
October	6,620	1,820	2,850	2.97	3.42	175,000	C.
November	7,480	2,120	3,440	3.58	3.99	205,000	B.
December	8,350	2,450	3,540	3.69	4.25	218,000	B.
The year	19,200	1,820	4,160	4.34	59.02	3,020,000	

NOTE.—Discharges interpolated June 5 to 7 and October 23 to 27, 1907; June 9 to 12, and September 10 to 23, 1908.

NORTH FORK OF SANTIAM RIVER AT DETROIT, OREG.

This station was established January 24, 1907, by J. G. Kelley, of Portland, who has cooperated with the U. S. Geological Survey in its maintenance. The station is located at a footbridge 1 mile above Detroit, about 1½ miles above the mouth of Britenbush Creek, and 2 miles below the mouth of Bowlder Creek.

The records are of particular use in furnishing data for the development of water power, for which this stream is exceptionally valuable (Pl. VIII).

As the low-water flow is the value specifically sought, no particular effort has been made to determine the flood discharge, and only the low-water records have been computed.

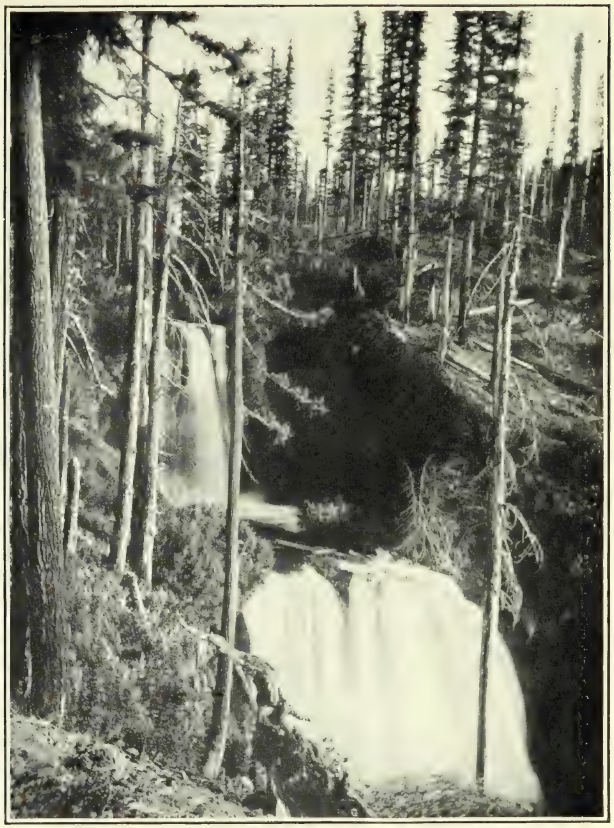
Discharge measurements of North Fork of Santiam River at Detroit, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 5	J. C. Stevens	60	456	1.21	433
1907.					
January 24	J. C. Stevens	63	543	1.80	742
March 26	I. E. Oakes	63	599	2.35	918
July 24	H. D. McGlashan	60	545	1.48	512

Daily gage height, in feet, of North Fork of Santiam River at Detroit, Oreg., for 1907 and 1908.

[Emma J. Lindes, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	.....	5.2	2.9	2.3	2.75	2.5	1.7	1.4	1.3	1.35	1.35	2.5
2	.....	4.5	2.9	2.3	2.7	2.5	1.75	1.4	1.3	1.35	1.35	2.3
3	.....	5.85	2.75	2.3	2.75	2.45	2.05	1.4	1.3	1.3	1.25	2.2
4	.....	9.2	2.8	2.35	2.75	2.3	1.85	1.4	1.3	1.3	1.2	2.2
5	.....	12.1	2.7	2.45	2.8	2.25	1.75	1.4	1.35	1.3	1.2	2.2
6	.....	9.05	2.6	2.75	2.9	2.2	1.7	1.4	1.3	1.25	1.15	2.1
7	.....	6.5	2.6	4.95	3.0	2.1	1.7	1.4	1.3	1.2	1.1	2.45
8	.....	5.6	2.5	4.95	3.0	2.0	1.7	1.5	1.2	1.2	1.1	2.5
9	.....	5.15	2.5	4.6	2.9	2.0	1.7	1.4	1.25	1.2	1.1	2.6
10	.....	5.0	2.5	4.8	3.25	2.15	1.65	1.4	1.3	1.2	1.1	2.6
11	.....	4.9	2.5	4.35	3.15	2.4	1.6	1.35	1.3	1.2	1.1	2.8
12	.....	4.35	2.5	4.15	2.95	2.25	1.6	1.3	1.3	1.2	1.1	3.2
13	.....	4.1	2.5	4.1	2.85	2.2	1.6	1.3	1.3	1.2	1.1	4.65
14	.....	3.95	2.35	4.0	2.8	2.1	1.6	1.3	1.25	1.2	1.3	3.85
15	.....	3.9	2.2	3.85	2.9	2.1	1.6	1.3	1.2	1.2	1.2	3.4
16	.....	3.9	2.1	3.7	3.0	2.0	.....	1.35	1.4	1.2	1.2	2.9
17	.....	3.7	2.2	3.5	2.95	2.0	.....	1.3	1.55	1.2	1.2	2.65
18	.....	3.55	2.15	3.85	2.9	2.0	.....	1.3	1.4	1.2	1.1	2.6
19	.....	3.5	2.25	4.05	3.1	2.0	1.5	1.3	1.3	1.2	1.35	2.5
20	.....	3.3	2.3	3.8	3.05	2.0	1.5	1.3	1.3	1.2	1.7	2.55
21	.....	3.2	2.55	3.7	2.8	2.0	1.5	1.2	1.3	1.2	1.55	6.5
22	.....	3.2	2.25	3.65	2.7	2.05	1.5	1.3	1.2	1.2	2.1	8.35
23	.....	3.2	2.1	3.55	2.8	2.05	1.5	1.3	1.2	1.1	2.0	7.4
24	.....	3.2	2.5	3.4	2.75	1.95	1.5	1.65	1.2	1.1	4.55	6.85
25	1.8	3.55	2.45	3.25	2.55	1.9	1.5	1.55	1.2	1.1	4.4	8.35
26	1.8	3.4	2.35	3.15	2.5	1.95	1.5	1.35	1.2	1.1	4.0	6.4
27	1.9	3.2	2.3	3.0	2.5	1.9	1.45	1.3	1.25	1.1	3.05	5.15
28	2.6	3.0	2.2	2.95	2.5	1.9	1.4	1.3	1.3	1.1	2.8	4.35
29	3.6	.....	2.2	2.85	2.5	1.8	1.4	1.3	1.25	1.4	2.8	3.8
30	3.2	.....	2.2	2.75	2.5	1.75	1.4	1.3	1.25	1.35	2.6	3.4
31	5.35	.....	2.3	.....	2.6	.....	1.4	1.3	.....	1.3	.....	3.2



A. TWIN FALLS ON NORTH FORK OF SANTIAM RIVER, JUST BELOW OUTLET OF MARION LAKE, OREGON.

B. GATCH FALLS ON NORTH FORK OF SANTIAM RIVER, 3 MILES BELOW TWIN FALLS.

Daily gage height, in feet, of North Fork of Santiam River at Detroit, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	3.0	1.9	2.1	2.4	3.2	2.6	2.4	1.55	1.35	1.1	2.65	1.8
2	2.95	1.85	2.0	2.4	3.3	2.6	2.4	1.5	1.3	1.1	2.2	1.8
3	3.05	1.9	1.9	2.5	3.3	2.6	2.45	1.5	1.3	1.15	1.9	1.8
4	2.65	2.1	1.9	2.5	3.1	2.5	2.35	1.5	1.3	1.1	1.8	1.7
5	2.65	2.4	1.8	2.4	3.1	2.5	2.2	1.45	1.3	1.05	1.65	1.6
6	2.55	2.3	1.75	2.3	3.2	2.5	2.2	1.4	1.3	1.0	1.5	1.6
7	2.6	2.2	1.7	2.3	3.65	2.5	2.2	1.4	1.3	1.0	1.5	1.6
8	2.6	2.1	1.7	2.2	3.3	2.75	2.1	1.4	1.3	1.0	1.5	1.6
9	3.05	2.1	1.7	2.2	3.0	3.1	2.1	1.4	1.3	1.0	1.5	1.6
10	2.95	2.0	1.7	2.25	2.9	3.05	2.05	1.4	1.3	1.0	1.5	1.5
11	2.9	2.1	1.75	2.45	2.8	3.0	2.0	1.4	1.3	1.0	1.45	1.65
12	2.8	2.0	1.9	2.7	2.8	3.0	2.1	1.4	1.3	1.05	1.4	1.65
13	2.7	1.9	2.15	2.9	2.6	2.9	2.1	1.4	1.25	1.4	1.4	1.7
14	2.7	1.9	2.9	3.0	2.5	2.9	2.05	1.4	1.2	2.6	1.3	1.7
15	2.6	1.9	8.7	3.1	2.7	2.9	2.0	1.4	1.2	2.2	1.3	1.7
16	2.5	1.95	8.05	3.15	2.7	2.9	1.95	1.4	1.2	1.8	1.3	1.7
17	2.5	2.0	6.75	3.7	2.7	2.7	1.75	1.4	1.2	1.6	1.35	1.7
18	2.5	1.9	4.95	4.5	3.05	2.6	1.7	1.4	1.2	1.4	2.0	1.6
19	2.7	1.9	4.5	4.5	3.1	2.6	1.7	1.4	1.2	1.5	1.85	1.5
20	3.3	1.9	4.0	4.35	3.1	2.6	1.7	1.4	1.2	1.65	2.95	1.4
21	3.05	1.8	3.45	4.05	3.0	2.6	1.7	1.4	1.15	1.5	2.9	1.55
22	2.85	1.8	3.3	3.7	3.0	2.5	1.7	1.4	1.1	1.5	3.5	1.65
23	2.7	1.7	3.2	3.75	3.0	2.4	1.7	1.4	1.1	1.5	3.2	1.7
24	2.5	1.7	3.25	4.65	2.9	2.4	1.7	1.3	1.1	1.5	2.9	1.75
25	2.4	1.7	3.2	3.95	2.8	2.4	1.7	1.3	1.1	1.5	2.5	1.95
26	2.3	1.8	3.2	3.7	2.9	2.5	1.6	1.3	1.1	1.5	2.35	2.1
27	2.2	2.1	2.8	3.6	2.9	2.4	1.6	1.3	1.1	1.5	2.2	2.6
28	2.2	2.1	2.7	3.4	2.9	2.3	1.6	1.4	1.1	1.5	2.1	3.0
29	2.05	2.1	2.6	3.3	2.8	2.3	1.6	1.5	1.1	1.6	2.0	2.8
30	2.05	.....	2.6	3.3	2.75	2.4	1.6	1.5	1.1	2.8	1.9	2.6
31	1.9	.....	2.5	.....	2.7	.....	1.6	1.4	.....	2.95	.....	2.4

Rating table for North Fork of Santiam River at Detroit, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	364	1.80	667	2.60	1,034
1.10	397	1.90	710	2.70	1,082
1.20	430	2.00	756	2.80	1,131
1.30	467	2.10	802	2.90	1,180
1.40	505	2.20	848	3.00	1,230
1.50	543	2.30	894	3.10	1,280
1.60	582	2.40	940		
1.70	624	2.50	987		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during 1906–7, and is fairly well defined between gage heights 1.2 feet and 2.4 feet.

Monthly discharge of North Fork of Santiam River at Detroit, Oreg., for 1907 and 1908.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
June	987	646	799	3.12	3.48	47,500	A.
July	779	505	584	2.28	2.63	35,900	A.
August	602	430	489	1.91	2.20	30,100	A.
September	562	430	461	1.80	2.01	27,400	A.
October	505	397	437	1.71	1.97	26,900	A.
November 1–23	802	397	385	1.50	1.28	17,600	A.
1908.							
June	1,280	894	1,050	4.10	4.57	62,500	B.
July	964	582	724	2.83	3.26	44,500	A.
August	562	467	509	1.99	2.29	31,300	A.
September	486	397	436	1.70	1.90	25,900	A.
October	1,200	364	551	2.15	2.48	33,900	A.

NORTH FORK OF SANTIAM RIVER AT MEHAMA, OREG.

This station, which was established July 5, 1905, was discontinued March 31, 1907. It was located just below the highway bridge at Mehama, about 1½ miles north of Lyons and 12 miles below the junction of Little North Fork and North Fork.

This stream is subject to excessive floods. During one of these the gaging equipment was destroyed and the station was abandoned in favor of the station at Detroit.

Discharge measurements of North Fork of Santiam River at Mehama, Oreg., in 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 6	I. E. Oakes	305	2,710	11.00	29,100
March 27	do	201	1,050	4.15	3,170

Mean daily gage height, in feet, of North Fork of Santiam River, at Mehama, Oreg., for 1907.

[F. U. Hull, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	4.7	8.7	4.9	11	4.6	6.4	4.5	21	3.55	4.7	4.9
2	4.5	7.9	4.7	12	4.4	6.0	4.6	22	3.5	4.7	4.9
3	6.6	8.9	4.5	13	4.0	5.8	4.2	23	3.6	4.8	4.7
4	8.2	13.4	4.4	14	3.8	5.5	4.2	24	3.6	4.8	4.6
5	6.4	14.0	4.3	15	3.8	5.3	4.1	25	3.55	5.4	4.4
6	5.7	10.9	4.2	16	3.8	5.2	4.0	26	3.55	5.1	4.2
7	5.2	8.5	4.2	17	3.7	5.2	4.0	27	3.55	4.9	4.4
8	4.9	7.7	4.2	18	3.7	5.0	5.2	28	3.6	4.8	4.1
9	4.6	7.0	4.3	19	3.6	4.9	5.0	29	7.1	.....	4.1
10	4.6	6.8	4.4	20	3.6	4.9	5.2	30	7.3	.....	4.2
								31	8.7	.....	4.5

Rating table for North Fork of Santiam River at Mehama, Oreg., for 1905, 1906, and 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	1,700	4.90	4,100	6.30	7,960	8.40	16,380
3.60	1,840	5.00	4,330	6.40	8,300	8.60	17,300
3.70	1,980	5.10	4,570	6.50	8,650	8.80	18,240
3.80	2,130	5.20	4,810	6.60	9,000	9.00	19,200
3.90	2,280	5.30	5,060	6.70	9,360	9.20	20,180
4.00	2,430	5.40	5,320	6.80	9,730	9.40	21,160
4.10	2,590	5.50	5,580	6.90	10,110	9.60	22,140
4.20	2,750	5.60	5,850	7.00	10,500	9.80	23,120
4.30	2,920	5.70	6,130	7.20	11,290	10.00	24,100
4.40	3,100	5.80	6,410	7.40	12,090	11.00	29,100
4.50	3,280	5.90	6,700	7.60	12,910	12.00	34,300
4.60	3,470	6.00	7,000	7.80	13,750	13.00	39,800
4.70	3,670	6.10	7,310	8.00	14,600	14.00	45,400
4.80	3,880	6.20	7,630	8.20	15,480		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 10 discharge measurements made during 1905–1907, and is well defined below gage height 4.5 feet.

Monthly discharge of North Fork of Santiam River at Mehama, Oreg., for 1907.

[Drainage area, 740 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	17,800	1,700	4,500	6.08	7.01	277,000	A.
February	45,400	3,670	10,900	14.7	15.31	605,000	B.
March	4,810	2,430	3,240	4.38	5.05	199,000	B.

SANTIAM RIVER AT JEFFERSON, OREG.

This station was established July 19, 1905, and was discontinued July 1, 1906, but was reestablished October 15, 1908. It is located at the highway bridge at Jefferson, 2½ miles below the junction of the North and South forks, measurements being made either from the highway bridge or from the Southern Pacific Railroad bridge. It is 9 miles above the mouth of the stream and below all tributaries.

The stream is particularly valuable for its water powers, although it seems probable that extensive use will be made of its waters for irrigation in the near future. The stream system is composed of two very dissimilar branches, the North and South forks. The total annual amount contributed by each fork is approximately the same, but the flow of the South Fork is very irregular, falling very low in the summer time and being subject to excessive and violent floods. The North Fork, on the other hand, maintains a well-established flow during the low-water season, and although the actual flood discharge is probably as high as that obtained from the South Fork, the value per square mile is considerably less.

The records obtained from the date of establishment to July 1, 1906, are not reliable. The gage was located on a pier of the bridge, and it was impossible to obtain even approximate heights during flood time. Since its reestablishment on October 15, however, the gage installed by the Jefferson Mill Company is used. It is located at the mill just above the bridge, where accurate heights can be obtained.

The following measurement was made October 15, 1908:

Width, 433 feet; area, 3,880 square feet; gage height, 3.75 feet; discharge, 9,550 second-feet.

Daily gage height, in feet, of Santiam River at Jefferson, Oreg., 1908.

[A. J. Shumaker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1						2.75	2.25			0.50	3.50	2.42
2						2.75	2.17			.50	2.75	2.17
3						2.75	2.00			.50	2.50	2.00
4						2.75				.50	2.00	1.92
5						2.67				.50	1.58	1.83
6						2.58	1.75			.50	1.58	
7						2.50	1.67			.50	1.50	1.67
8						2.42		0.67		.50	1.42	1.67
9						2.67				.50	1.42	1.67
10						2.83	1.50			.50	1.33	1.58
11						2.83				.50	1.33	1.50
12						2.58				.50	1.25	1.50
13						2.42	1.33			.50	1.17	
14							1.33			3.08	1.08	3.17
15			16.00		3.00	2.25	1.33			3.75		2.50
16			15.25		4.50	2.25	1.25			3.33	1.05	2.42
17						2.17	1.17	.58		2.42	1.08	2.25
18					5.00	2.17					1.17	2.00
19					5.00	2.42				1.75	2.71	1.92
20					5.00	2.83	1.17			3.45	2.67	
21					4.75	3.17				2.88	4.75	1.75
22					4.33	4.00				2.25	5.92	1.67
23					4.00	3.25	1.00			2.00	6.00	2.50
24					3.75	2.83		.58		1.83	5.50	4.29
25					3.58	2.58				1.67	4.50	3.25
26					3.42	2.50				1.67	3.83	5.67
27					3.17	2.75	.83			1.58	3.25	
28					3.00	2.58				1.58	2.92	4.50
29					2.83	2.33		.75		1.54		6.58
30					2.92	2.25		1.33		1.75	2.75	5.00
31					2.75			1.08		4.00		4.50

MARION FORK OF SANTIAM RIVER AT MARION LAKE, NEAR DETROIT, OREG.

This station was established February 23, 1907, by J. G. Kelley, of Portland, through whose courtesy the records are furnished. It is located about 200 feet below the outlet of Marion Lake, 30 miles from Detroit, from which town it is reached by trail. The gage heights are obtained by measuring down from a reference point. The results will be of value in connection with the development of water powers on this stream. The individual measurements are accurate, but on account of the isolation of the station it has been impossible to obtain a sufficient number of measurements and heights to insure reliable estimates of flow.

Discharge measurements of Marion Fork of Santiam River at Marion Lake, near Detroit, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 7	J. C. Stevens	31	51	5.55	77
1907.					
July 27	H. D. McGlashan	31	45	5.50	85

Daily gage height, in feet, of Marion Fork of Santiam River at Marion Lake, near Detroit, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1												
2							5.85					
3						6.30	5.85					
4						6.30	5.85			5.69		
5		8.50	5.75			6.30	5.85					
6			5.75							5.60		
7			5.76									
8			5.77									
9								5.59	5.55			
10									5.71			
11					6.58			5.55			5.69	
12				6.31	6.52							
13				6.33	6.50							
14				6.34								
15			5.67	6.31								
16			5.68				5.75					
17			5.72									
18			5.77			5.88			5.55			
19						5.88		5.52	5.83			
20												
21						5.85						
22												
23		6.00										
24		6.12		6.25	6.45		5.68					
25		6.11		6.22	6.41							
26		6.06	5.75	6.16	6.30			5.71				
27			5.78									
28			5.78				2.75					
29			5.71									
30			5.66									
31												

PUZZLE CREEK NEAR DETROIT, OREG.

This station was established February 23, 1907, by J. G. Kelley, of Portland, who furnishes the records. The gage heights are obtained by measuring down from a reference point which has an assumed elevation of 10.0 feet. The stream has a prodigious fall, and the results will be of considerable value for the general study of water-power development on the North Fork of the Santiam.

The station is located about 50 feet above the mouth of the stream, in the only point where the water is quiet enough to admit of even an approximate gaging being made. The station is isolated, and

the conditions are very poor, so that the results can be used only for approximate estimates of flow.

Discharge measurements of Puzzle Creek near Detroit, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1906.					
September 7	J. C. Stevens	19	26	6.16	65
1907.					
July 27	H. D. McGlashan	19	33	6.15	94

Daily gage height, in feet, of Puzzle Creek near Detroit, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1												
2							6.18					
3										6.05		
4						5.91						
5		7.67	5.95				6.08					
6						5.82				6.00		
7												
8			6.20									
9								5.97	6.00			
10												
11					5.91						6.00	
12				6.12				5.97				
13					6.00						5.98	
14												
15			6.00	6.08								
16							6.18					
17						6.18						
18			6.17						6.18			
19								5.92				
20						6.26						
21												
22		6.17								5.92		
23												
24					5.96		6.30					
25												
26		6.00	5.91	6.04	5.91			6.18				
27								6.18				
28							6.28					
29												
30												
31												

PERMELIA CREEK NEAR DETROIT, OREG.

This station was established February 23, 1907. It is located at the Minto trail crossing in sec. 33, T. 10 S., R. 7 E., about one-half mile above the mouth of the stream. The station has been maintained by J. G. Kelley, of Portland, who furnishes the records.

The data are valuable principally in connection with a general study of the possibilities for water-power development in the North Fork of Santiam River. The gage heights are obtained by measuring down from a reference point. No heights were reported during 1908.

Discharge measurements of Permelia Creek near Detroit, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1906. September 6	J. C. Stevens	39	32	4.80	80
1907. July 26	H. D. McGlashan	43	38	5.05	127

Daily gage height, in feet, of Permelia Creek near Detroit, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1												
2							5.21					
3										4.92		
4						5.25						
5		7.58	5.12				5.21					
6						5.25				4.89		
7												
8			5.10									
9								5.00				
10												
11					5.33			5.00			4.83	
12				5.62								
13					5.21						4.83	
14												
15			5.04	5.54								
16							6.19					
17						5.10						
18			5.12						4.89			
19												
20						5.10						
21												
22										4.83		
23		5.42										
24				5.41	5.30					4.83		
25												
26		5.38		5.33	5.18							
27												
28												
29												
30			5.66									
31												

WHITEWATER CREEK NEAR DETROIT, OREG.

This station was established February 23, 1907, and has been maintained by J. G. Kelley, of Portland, by whom the records are supplied. It is located about one-quarter mile above the mouth of the stream, in the NW. ¼ sec. 21, T. 10 S., R. 7 E., and is reached by trail from Detroit.

The data from this station are of value in the general study of the water-power possibilities of the North Fork of Santiam River. Gage readings are obtained by measuring down from a reference point which has an assumed elevation of 10.0 feet. Sufficient measurements have not been made to develop a reliable rating curve, and the chief dependence for data will be the measurements that have been obtained. No gage heights were obtained during 1908.

Discharge measurements of Whitewater Creek near Detroit, Oreg., in 1906 and 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1906. September 6	J. C. Stevens	32	28	5.51	65
1907. July 26	H. D. McGlashan	28	27	6.63	69

Daily gage height, in feet, of Whitewater Creek near Detroit, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1												
2							6.80					
3										6.51		
4						6.80						
5			6.77									
6						6.70	6.60			6.43		
7												
8			7.17									
9								6.68				
10												
11					7.37			6.68			6.48	
12				7.08								
13					6.87						6.48	
14												
15			6.69									
16							6.68					
17						6.68						
18			6.88						6.50			
19												
20						6.85						
21												
22										6.39		
23												
24				6.95	6.80					6.39		
25												
26			6.70		6.80							
27												
28												
29												
30			6.91									
31												

SOUTH FORK OF SANTIAM RIVER AT WATERLOO, OREG.

This station was established July 28, 1905, and was discontinued March 31, 1907. It was located one-half mile below the highway bridge at Waterloo, about 4 miles above the mouth of Hamilton Creek, and 3 miles above the dam by means of which water is diverted into a power canal for use in the town of Albany. The floods of November, 1906, destroyed the gaging equipment, and although the records are of considerable value the available funds would not permit of its reestablishment.

Daily gage height, in feet, of South Fork of Santiam River at Waterloo, Oreg., for 1907.

[J. B. Huddleson, observer.]

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	3.5	8.5	3.6	11	3.6	19.0	3.7	21	2.5	5.6	5.1
2	4.0	7.3	3.7	12	3.4	14.0	3.3	22	2.4	5.5	7.5
3	4.0	11.5	3.7	13	3.2	11.0	3.1	23	2.4	4.5	7.0
4	10.4	12.5	3.1	14	3.2	11.0	3.0	24	2.7	4.5	3.7
5	6.4	14.7	3.2	15	3.0	7.6	3.1	25	2.7	4.4	3.6
6	6.4	16.8	3.4	16	3.1	7.6	3.0	26	2.9	4.4	3.4
7	6.5	14.9	3.1	17	2.5	5.7	3.2	27	3.5	4.4	3.2
8	5.0	12.9	3.3	18	2.5	5.9	3.3	28	9.1	4.7	3.0
9	4.5	19.5	3.1	19	2.5	5.8	5.7	29	10.4	.....	3.0
10	3.9	20.0	3.7	20	2.6	5.7	4.5	30	8.4	.....	3.1
								31	8.9	.....	3.3

Rating table for South Fork of Santiam River at Waterloo, Oreg., for 1905, 1906, and 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	1,730	4.00	4,760	5.60	9,190	8.40	18,360
2.50	1,870	4.10	5,010	5.70	9,500	8.60	19,040
2.60	2,020	4.20	5,260	5.80	9,810	8.80	19,720
2.70	2,180	4.30	5,520	5.90	10,130	9.00	20,400
2.80	2,340	4.40	5,780	6.00	10,450	10.00	23,900
2.90	2,510	4.50	6,040	6.20	11,090	11.00	27,500
3.00	2,680	4.60	6,310	6.40	11,730	12.00	31,200
3.10	2,860	4.70	6,580	6.60	12,380	13.00	35,000
3.20	3,050	4.80	6,850	6.80	13,040	14.00	38,800
3.30	3,240	4.90	7,120	7.00	13,700	15.00	42,700
3.40	3,440	5.00	7,400	7.20	14,360	16.00	46,700
3.50	3,640	5.10	7,690	7.40	15,020	17.00	50,800
3.60	3,850	5.20	7,980	7.60	15,680	18.00	55,000
3.70	4,070	5.30	8,280	7.80	16,340	19.00	59,300
3.80	4,290	5.40	8,580	8.00	17,000	20.00	63,700
3.90	4,520	5.50	8,880	8.20	17,680		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during 1905–6, and is well defined between gage heights 0.9 foot and 4.0 feet.

Monthly discharge of South Fork of Santiam River at Waterloo, Oreg., for 1907.

[Drainage area, 640 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	25,300	1,730	7,060	11.0	12.68	434,000	B.
February	63,700	5,780	23,800	37.2	38.74	1,320,000	C.
March	15,400	2,680	4,430	6.92	7.98	272,000	A.

LUCKIAMUTE RIVER NEAR SUVER, OREG.

This station was established August 18, 1905, and has been maintained continuously since that date. It is located just below Helmick bridge on the public highway, 4 miles south of Monmouth and 3 miles below the junction of the North and South forks.

The results furnish data valuable in the general study of run-off from the forested areas of the eastern slope of the Coast Range and are comparable in a general way with the records on Yamhill River. The river is subject to excessive and violent floods, due to the sudden melting of snows on the mountain slopes. At the station the river flows in a comparatively deep canyon and the records are believed to be reliable.

Discharge measurements of Luckiamute River near Suver, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 3	I. E. Oakes	81	619	9.30	1,320
July 31	J. C. Stevens	56	102	1.35	67
November 26	H. D. McGlashan	115	1,610	19.45	4,270
1908.					
February 10	H. D. McGlashan	84	713	10.30	1,520
September 12	do	54	110	1.40	64

Daily gage height, in feet, of Luckiamute River near Suver, Oreg., for 1907.

[Marie Helmick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	10.1	22.1	9.0	8.7	4.5	3.2	2.05	1.2	1.05	1.3	1.45	10.8
2	10.3	20.3	9.5	7.3	4.4	3.1	1.95	1.25	1.15	1.6	1.5	9.0
3	15.5	19.7	10.4	7.4	4.3	3.1	2.05	1.2	1.5	1.9	3.1	7.2
4	30.0	23.1	9.0	7.6	4.5	3.1	2.2	1.25	1.3	1.9	2.3	9.8
5	26.2	27.6	8.0	7.5	5.9	2.8	2.4	1.15	1.15	1.7	1.7	7.4
6	22.3	27.4	7.1	12.1	4.5	2.35	1.9	1.15	1.05	1.8	1.5	9.7
7	17.7	24.9	7.0	21.6	3.8	2.55	2.3	1.25	1.1	1.4	1.4	9.8
8	14.4	19.1	8.0	23.9	3.6	2.8	1.75	1.2	1.1	1.2	1.4	10.4
9	12.9	16.0	6.0	19.4	3.4	2.6	1.7	1.3	1.05	1.1	1.2	10.5
10	10.7	14.2	8.0	16.3	3.1	2.8	1.65	1.35	1.1	1.05	1.2	10.8
11	9.2	12.6	9.7	15.5	4.0	3.15	1.6	1.25	1.05	1.05	1.1	13.7
12	8.5	12.0	8.4	12.3	4.3	2.75	1.65	1.1	.9	1.0	1.15	15.4
13	8.5	10.7	8.0	11.1	4.2	3.0	1.6	1.15	.85	1.0	1.25	24.2
14	8.5	9.6	7.5	9.0	3.9	3.0	1.55	1.15	.85	.9	1.4	26.0
15	8.0	8.8	8.6	8.6	3.5	2.8	1.5	1.2	1.1	1.0	1.45	20.7
16	7.5	8.6	7.4	8.0	3.4	2.3	1.55	1.1	1.1	.95	1.5	15.2
17	7.0	8.0	7.0	7.6	3.4	2.65	1.5	1.05	2.0	.95	1.4	11.3
18	5.9	8.1	11.2	7.8	3.1	2.5	1.45	1.1	2.5	.95	1.6	11.2
19	6.0	8.2	11.8	7.5	3.8	2.6	1.5	1.15	1.85	.9	2.3	10.5
20	6.2	8.5	8.2	7.2	3.6	2.45	1.45	1.1	1.5	.9	3.8	14.2
21	5.8	8.0	7.4	7.0	3.4	2.3	1.45	1.2	1.2	.95	7.5	14.8
22	6.2	5.3	8.0	6.4	3.2	2.25	1.5	1.05	1.0	1.0	4.8	26.4
23	6.2	6.2	10.1	6.1	3.7	2.15	1.45	1.0	1.1	1.0	9.5	26.4
24	6.4	7.5	11.4	5.8	3.8	2.2	1.4	1.15	1.55	1.0	16.0	23.9
25	7.0	8.0	10.0	5.5	3.9	2.25	1.55	1.2	1.1	1.0	23.0	24.0
26	6.2	10.4	10.5	5.1	3.9	2.1	1.4	1.2	1.05	1.0	19.4	27.3
27	6.8	9.7	9.4	5.0	3.7	2.2	1.4	1.15	1.15	.95	12.5	24.3
28	9.0	8.6	9.2	4.9	3.7	2.0	1.2	1.1	1.1	.9	14.0	22.3
29	16.0	.....	9.6	4.8	3.6	2.15	1.1	1.15	1.2	.9	11.7	18.5
30	13.7	.....	8.9	4.6	3.5	2.1	1.3	1.2	1.15	1.45	12.0	16.5
31	17.3	.....	8.7	.....	3.3	.....	1.25	1.1	.....	1.3	.....	14.6

Daily gage height, in feet, of Luckiamute River near Suver, Oreg., for 1908.

[Mrs. P. C. Bush, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	17.4	7.0	7.3	7.9	6.8	3.9	2.4	1.4	2.5	1.2	7.5	4.8
2	17.4	7.0	7.6	8.0	6.3	3.5	2.4	1.3	2.55	1.15	5.5	4.75
3	18.3	7.0	7.8	8.0	8.0	3.4	2.25	1.2	.....	1.15	4.15	4.5
4	17.7	7.4	7.2	8.0	7.6	3.4	2.15	1.0	.....	1.2	3.8	4.2
5	14.2	10.5	7.0	6.6	7.0	3.7	2.3	1.2	.....	1.25	3.5	4.0
6	13.5	18.5	6.8	6.6	6.8	3.8	2.25	1.3	.....	1.3	3.3	4.0
7	13.0	20.3	6.3	6.4	6.0	3.5	2.2	1.2	.....	1.35	3.1	4.1
8	12.9	14.8	6.0	6.2	5.5	3.3	2.15	1.25	.....	1.4	3.0	4.0
9	19.0	13.6	5.5	6.0	5.3	3.05	2.1	1.3	.....	1.4	2.9	3.95
10	14.4	10.7	5.6	5.7	5.1	2.8	2.0	1.3	.....	1.45	2.5	3.9
11	16.2	9.5	6.2	5.5	5.0	2.7	1.9	1.35	.....	1.3	2.0	4.5
12	14.1	9.8	6.5	5.5	4.8	2.6	2.0	1.3	1.4	1.25	2.5	5.0
13	12.0	9.1	10.5	5.2	4.6	2.5	2.2	1.35	1.45	1.4	2.9	6.0
14	13.75	8.5	16.3	4.7	5.0	2.5	2.3	1.3	1.5	4.0	3.0	7.5
15	11.0	7.6	20.3	4.5	5.6	2.5	2.2	1.25	1.55	6.0	2.6	7.9
16	11.0	8.3	27.5	4.4	5.5	2.75	1.95	1.2	1.55	4.5	2.3	8.0
17	12.7	10.0	23.8	4.9	5.5	2.85	1.9	1.2	1.5	3.0	4.0	8.4
18	13.5	9.8	18.5	4.5	5.7	2.85	1.85	1.3	1.4	2.5	4.7	8.8
19	11.3	9.5	14.7	4.5	5.8	2.1	1.8	1.25	1.45	1.75	4.5	6.0
20	14.7	8.2	12.4	11.0	6.0	3.15	1.8	1.4	1.4	2.0	6.0	5.3
21	15.7	8.0	11.2	9.0	5.8	3.15	1.8	1.3	1.3	2.5	8.8	7.5
22	12.3	7.5	10.0	8.0	5.4	2.9	1.8	1.3	1.25	3.3	13.0	9.8
23	12.1	7.0	9.2	7.5	5.0	2.1	1.75	1.2	1.25	3.0	14.5	11.6
24	11.0	6.5	8.6	9.0	4.8	2.75	1.7	1.3	1.3	2.9	11.7	12.9
25	11.0	6.3	9.5	11.5	4.6	2.68	1.7	1.4	1.35	2.1	10.2	13.7
26	10.5	6.9	8.3	9.6	4.5	2.6	1.6	1.35	1.3	2.2	8.9	14.7
27	10.0	7.5	8.2	8.0	4.3	3.15	1.6	1.4	1.3	2.4	7.5	12.8
28	9.0	7.3	8.0	7.5	4.3	3.0	1.65	1.65	1.2	2.5	6.4	13.5
29	8.3	7.2	8.0	7.2	4.1	2.65	1.7	1.8	1.25	2.7	6.8	14.8
30	7.0	.....	8.0	7.0	4.0	2.55	1.5	2.2	1.25	2.9	5.1	12.5
31	7.0	.....	7.5	.....	3.9	.....	1.45	2.3	.....	8.4	.....	10.0

Rating table for Luckiamute River near Suver, Oreg., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	34	2.60	173	4.80	455	14.00	2,475
.90	39	2.70	184	5.00	485	15.00	2,775
1.00	44	2.80	195	5.20	515	16.00	3,085
1.10	50	2.90	206	5.40	545	17.00	3,410
1.20	56	3.00	218	5.60	575	18.00	3,750
1.30	62	3.10	230	5.80	610	19.00	4,110
1.40	69	3.20	242	6.00	645	20.00	4,490
1.50	76	3.30	254	6.20	680	21.00	4,900
1.60	83	3.40	267	6.40	715	22.00	5,320
1.70	91	3.50	280	6.60	750	23.00	5,770
1.80	99	3.60	293	6.80	785	24.00	6,240
1.90	107	3.70	306	7.00	820	25.00	6,740
2.00	115	3.80	319	8.00	1,020	26.00	7,250
2.10	124	3.90	332	9.00	1,225	27.00	7,780
2.20	133	4.00	345	10.00	1,440	28.00	8,320
2.30	143	4.20	371	11.00	1,680	29.00	8,880
2.40	153	4.40	397	12.00	1,930	30.00	9,450
2.50	163	4.60	425	13.00	2,200		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 11 discharge measurements made during 1905–1908, and is well defined between gage heights 1.3 feet and 20.0 feet. Below gage height 3.9 feet it is the same as the 1905–6 table.

Monthly discharge of Luckiamute River near Suver, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Total run-off in acre-feet.	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	9,450	610	2,020	124,000	A.
February	8,100	530	2,660	148,000	A.
March	1,880	645	1,200	73,800	A.
April	6,190	425	1,500	89,300	A.
May	628	230	325	20,000	A.
June	242	115	173	10,300	A.
July	153	50	86.4	5,310	A.
August	66	44	54.0	3,320	B.
September	163	36	59.6	3,550	B.
October	107	39	55.1	3,390	B.
November	5,770	50	869	51,700	A.
December	7,940	860	3,460	213,000	A.
The year	9,450	36	1,040	746,000	
1908.					
January	4,110	820	2,260	139,000	A.
February	4,610	698	1,380	79,400	A.
March	8,050	560	1,750	108,000	A.
April	1,800	397	840	50,000	A.
May	1,020	332	562	34,660	A.
June	332	124	214	12,700	A.
July	153	72	112	6,890	A.
August	143	44	68.2	4,190	A.
September[a]	168	56	88.8	5,280	A.
October	1,100	53	184	11,300	A.
November	2,620	115	661	39,300	A.
December	2,720	332	1,090	67,000	A.
The year	8,050	44	768	558,000	

[a] Discharge interpolated September 3 to 11.

SOUTH FORK OF YAMHILL RIVER AT SHERIDAN, OREG.

This station was established April 25, 1906. It is located at the highway bridge in Sheridan, 2 miles below the mouth of Mill Creek.

The records determine in a general way the run-off from the eastern slope of the Coast Range and are particularly valuable in the study of forestry and run-off conditions. It is also probable that the waters will be used in the near future for irrigation.

No change in gage datum has occurred since the station was established, and the records are believed to be fairly reliable, although the conditions are not ideal. The banks of the river are densely covered with willows and brush that render the accurate determination of flood discharge difficult.

Discharge measurements of South Fork of Yamhill River at Sheridan, Oreg., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	L. R. Allen	124	494	2.70	813
May 18	do	123	453	2.34	625
July 1	do	116	374	1.81	436
September 7	I. E. Oakes	106	211	.30	48
October 30	do	117	369	1.80	423
1907.					
July 30[a]	J. C. Stevens			.40	67
November 27	H. D. McGlashan	135	917	6.20	3,690
1908.					
January 9	C. E. Ellsworth	152	1,180	7.72	5,180
January 10	do	143	1,020	6.55	3,850
February 11	H. D. McGlashan	130	738	4.60	2,130
March 16	do	174	1,500	9.90	7,620
March 17	do	162	1,290	8.60	6,050
Do	do	157	1,210	8.10	5,740
September 9	do	120	244	.49	64

[a] Measured by wading.

Daily gage height, in feet, of South Fork of Yamhill River at Sheridan, Oreg., for 1907.

[George Schoppert, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
1	4.2	10.2	3.7	3.7	2.0	1.3	0.7	0.9	0.3	0.2	5.8
2	4.0	9.5	4.0	3.5	1.9	1.2	.....	.9	.3	.2	5.8
3	18.25	8.0	3.8	3.4	1.9	1.2	.....	.9	.4	.2	4.8
4	16.0	8.2	3.6	3.2	1.8	1.2	.....	.9	.5	.3	3.8
5	9.5	14.3	3.3	4.2	1.8	1.2	.....	.9	.4	.3	4.0
6	6.5	10.5	3.2	7.5	1.7	1.1	.....	.9	.3	.3	4.0
7	6.0	8.5	3.1	11.4	1.7	1.1	.....	.9	.3	.3	5.0
8	5.0	6.5	3.0	9.2	1.7	1.1	.....	.8	.2	.3	5.0
9	4.0	5.5	2.9	7.0	1.7	1.1	.....	.8	.2	.2	5.1
10	3.6	4.4	2.9	6.2	1.7	1.0	.....	.7	.2	.2	4.8
11	3.4	4.0	2.9	5.5	1.6	1.0	.....	.6	.2	.3	7.2
12	3.3	3.8	3.0	4.5	1.6	1.0	.....	.5	.2	.3	6.3
13	3.1	3.6	2.8	4.3	1.7	1.0	.....	.4	.2	.4	15.0
14	3.0	3.5	2.8	3.7	1.7	1.0	.....	.3	.2	.4	9.9
15	3.0	3.2	2.9	3.5	1.7	1.0	.....	.3	.2	.5	7.5
16	3.0	3.0	2.9	3.5	1.6	.9	.....	.2	.2	.5	6.0
17	3.0	2.9	3.0	3.4	1.6	.9	.....	.3	.2	.5	6.5
18	2.9	2.7	3.2	3.2	1.5	.9	.....	.4	.2	.6	5.0
19	3.0	2.5	3.0	3.0	1.5	.9	.....	.4	.2	1.0	4.5
20	3.0	2.4	3.0	3.0	1.6	.9	.....	.4	.2	2.5	7.6
21	3.0	2.3	3.0	3.0	1.5	.9	.....	.3	.2	3.0	8.0
22	3.0	2.3	3.6	2.5	1.5	.9	.....	.3	.2	3.5	8.5
23	2.9	2.3	4.0	2.4	1.5	.8	.....	.2	.2	4.0	9.5
24	2.8	2.9	3.8	2.4	1.5	.8	.....	.2	.2	11.5	9.0
25	2.7	4.0	3.5	2.3	1.5	.8	.....	.2	.2	9.7	8.0
26	2.7	4.2	3.4	2.3	1.5	.8	.....	.2	.2	7.6	13.5
27	2.8	3.6	3.0	2.2	1.5	.7	.....	.3	.2	6.7	9.5
28	4.0	3.4	3.6	2.2	1.5	.7	.....	1.0	.2	6.6	7.2
29	6.0	.....	3.5	2.0	1.4	.7	.....	1.0	.2	6.6	7.0
30	4.3	.....	3.5	2.0	1.4	.7	.4	.5	.2	5.8	6.3
31	9.0	.....	3.5	.....	1.3	.....	.....	.....	.2	.....	6.3

Daily gage height, in feet, of South Fork of Yamhill River at Sheridan, Oreg., for 1908.

[J. F. Bjornson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.0	3.0	3.4	3.9	3.2	2.0	1.3	0.65	0.56	0.60	4.8	3.0
2	9.0	2.9	3.6	3.8	3.0	1.9	1.2	.65	.54	.64	4.4	2.8
3	8.8	3.1	3.5	3.8	3.9	1.9	1.2	.65	.54	.66	4.1	2.7
4	6.8	3.2	3.1	3.7	3.9	1.8	1.0	.62	.52	.65	3.9	2.3
5	6.4	6.7	3.0	3.7	4.0	1.8	1.0	.62	.52	.65	3.6	2.0
6	6.1	10.9	2.8	3.0	4.1	1.7	1.0	.60	.60	.67	3.0	1.9
7	5.6	7.1	2.6	3.5	3.9	1.7	.90	.60	.58	.70	2.6	1.9
8	5.6	6.8	2.5	3.5	3.4	1.6	.90	.60	.54	.75	2.4	1.7
9	8.3	6.0	2.4	3.3	3.1	1.6	.90	.58	.54	.75	2.2	1.5
10	6.6	5.4	2.4	3.3	3.0	1.6	.80	.58	.52	.72	2.0	2.0
11	6.5	4.8	2.3	3.1	2.9	1.5	.80	.58	.52	.90	1.8	2.5
12	5.8	4.2	3.0	3.0	2.8	1.5	.80	.55	.55	2.0	1.3	3.0
13	5.5	4.0	4.5	2.9	2.4	1.4	.80	.55	.48	2.25	1.1	2.8
14	5.0	3.9	6.0	2.9	2.4	1.4	.75	.55	.47	2.0	1.0	2.6
15	4.8	3.8	14.0	2.7	2.3	1.4	.75	.52	.47	1.9	.90	2.0
16	4.6	4.4	12.5	2.6	2.1	1.3	.75	.52	.45	2.1	.84	2.0
17	5.2	5.3	8.2	4.1	2.0	1.3	.70	.50	.50	2.5	2.0	1.7
18	4.8	4.8	6.3	8.0	2.4	1.2	.70	.50	.54	2.0	4.5	1.6
19	4.8	4.7	5.0	6.0	2.8	2.5	.70	.52	.60	2.1	6.9	1.4
20	7.6	4.5	5.0	5.4	3.0	3.4	.70	.55	.60	1.7	8.5	1.8
21	6.3	4.2	4.9	4.9	3.1	3.0	.65	.70	.60	1.3	7.4	1.6
22	5.5	3.8	4.8	4.5	2.8	2.7	.65	.70	.65	1.1	6.8	3.8
23	6.4	3.4	4.8	7.0	2.6	2.5	.65	.68	.65	1.0	6.3	5.3
24	5.2	3.0	4.7	6.0	2.5	2.0	.65	.68	.70	.90	5.2	7.7
25	4.4	2.8	4.5	5.1	2.5	2.9	.65	.66	.70	1.5	5.0	8.15
26	4.2	2.6	4.5	5.0	2.4	2.9	.75	.64	.65	2.1	5.0	7.8
27	3.6	2.4	4.3	4.5	2.4	2.6	.75	.62	.60	2.6	4.4	8.3
28	3.2	2.6	4.1	4.0	2.2	2.5	.75	.62	.60	3.2	3.9	7.3
29	3.4	3.0	4.0	3.5	2.2	2.4	.72	.60	.62	4.1	3.4	7.0
30	3.2	.....	3.9	3.3	2.1	2.2	.70	.58	.64	4.8	3.0	6.3
31	3.1	.....	4.1	.....	2.0	.....	.70	.58	.....	5.1	.....	6.0

Rating tables for South Fork of Yamhill River at Sheridan, Oreg.

APRIL 25, 1906, TO DECEMBER 31, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	38	1.80	428	3.40	1,235	6.00	3,390
.30	51	1.90	464	3.50	1,300	6.20	3,590
.40	65	2.00	500	3.60	1,370	6.40	3,790
.50	80	2.10	540	3.70	1,440	6.60	3,990
.60	97	2.20	580	3.80	1,510	6.80	4,190
.70	116	2.30	625	3.90	1,585	7.00	4,390
.80	137	2.40	670	4.00	1,660	8.00	5,450
.90	159	2.50	715	4.20	1,810	9.00	6,560
1.00	183	2.60	765	4.40	1,970	10.00	7,720
1.10	208	2.70	815	4.60	2,130	11.00	8,920
1.20	235	2.80	870	4.80	2,300	12.00	10,150
1.30	264	2.90	925	5.00	2,470	13.00	11,400
1.40	294	3.00	980	5.20	2,645	14.00	12,650
1.50	326	3.10	1,040	5.40	2,825	15.00	13,900
1.60	359	3.20	1,105	5.60	3,010		
1.70	393	3.30	1,170	5.80	3,200		

1908.[b]

0.40	50	0.70	105	1.00	178	1.30	264
.50	67	.80	127	1.10	205	1.40	294
.60	85	.90	152	1.20	234		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 7 discharge measurements made during 1906 and 1907, and 6 high-water measurements made during 1908. It is well defined between gage heights 0.3 foot and 10.0 feet.

[b] This table is applicable only for open-channel conditions. It is based upon 1 discharge measurement made during 1908 at low water and is well defined. Above gage height 1.4 feet it is the same as the 1907 table.

Monthly discharge of South Fork of Yamhill River at Sheridan, Oreg., for 1906, 1907, and 1908.

[Drainage area, 290 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
April 25-30	765	580	663	2.29	.51	7,890	A.
May	925	393	619	2.13	2.46	38,100	A.
June	2,470	428	915	3.16	3.53	54,400	A.
July	464	137	225	.776	.89	13,800	A.
August	137	51	81.0	.279	.32	4,980	A.
September	393	38	149	.514	.57	8,870	A.
November	13,300	500	3,780	13.0	14.50	225,000	A.
December	9,650	625	2,990	10.3	11.87	184,000	A.
The period						537,000	
1907.							
January	18,100	815	2,800	9.66	11.14	172,000	A.
February	13,000	625	2,940	10.1	10.52	163,000	A.
March	1,660	870	1,160	4.00	4.61	71,300	A.
April	9,400	500	1,920	6.62	7.39	114,000	A.
May	500	264	366	1.26	1.45	22,500	A.
June	264	116	175	.603	.67	10,400	A.
September	183	38	96.1	.331	.37	5,720	A.
October	80	38	42.8	.148	.17	2,630	B.
November	9,520	38	1,430	4.93	5.50	85,100	A.
December	13,900	1,510	4,540	15.7	18.10	279,000	A.
The period						926,000	
1908.							
January	6,560	1,040	3,180	11.0	12.68	196,000	A.
February	8,800	670	2,120	7.31	7.88	122,000	A.
March	12,600	625	2,460	8.48	9.78	151,000	A.
April	5,450	765	1,860	6.41	7.15	111,000	A.
May	1,740	500	918	3.17	3.66	56,400	A.
June	1,240	234	533	1.84	2.05	31,700	A.
July	264	95	134	.462	.53	8,240	A.
August	105	67	85.1	.293	.34	5,230	B.
September	105	58	79.6	.274	.31	4,740	B.
October	2,560	85	518	1.79	2.06	31,900	A.
November	6,000	137	1,760	6.07	6.77	105,000	A.
December	5,780	294	1,750	6.03	6.95	108,000	A.
The year	12,600	58	1,280	4.43	60.16	931,000	

YAMHILL RIVER AT LA FAYETTE, OREG.

This station, which was established October 6, 1908, for the purpose of developing a rating curve to be applied to old records of gage height obtained at the locks by the United States Weather Bureau and the United States Army engineers, is located at the county highway bridge at La Fayette, Oreg., three-fourths of a mile above the locks and about 1½ miles below the junction of the North and South forks.

The data will be particularly valuable for determining the run-off from areas draining the eastern slope of the Coast Range. The run-off on this range is exceedingly high and the river is subject to excessive floods. They will also complete the study of general run-off conditions in the Willamette Valley.

At the present time sufficient measurements have not been obtained to rate the station.

Daily gage heights, in feet, of Yamhill River at La Fayette, Oreg., for 1908.

[H. W. Koch, Observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		3.9	3.2	16	2.3	2.1	4.9
2		3.5	3.3	17	2.0	2.1	3.7
3		3.5	3.2	18	2.0	2.4	4.0
4		3.2	3.1	19	1.8	3.3	3.7
5		3.0	3.0	20	2.0	2.9	3.7
6	1.2	2.7	2.8	21	2.4	4.3	3.5
7	.95	2.4	3.0	22	2.5	6.5	4.5
8	.9	2.4	2.9	23	2.0	7.0	4.2
9	1.0	2.4	3.2	24	2.0	7.5	7.0
10	1.2	2.2	3.1	25	1.9	6.4	5.7
11	1.2	2.1	3.0	26	1.8	5.5	7.3
12	1.2	2.1	3.1	27	1.8	5.0	7.1
13	1.3	2.1	4.7	28	1.7	3.7	8.0
14	1.3	2.1	5.2	29	1.7	3.8	7.8
15	3.4	2.1	4.2	30	1.9	3.2	7.0
				31	3.2		6.5

MOLALLA RIVER NEAR MOLALLA, OREG.

This station, which was established November 1, 1905, is located 3 miles below the mouth of the North Fork of the Molalla on the farm of Raymond Dickey, 3½ miles southeast of Molalla post-office.

This will probably be one of the first streams to be used for irrigation in the Willamette Valley, and for this reason the data are particularly valuable. The records also furnish a measure of the run-off from streams draining the foothills of the Cascades from which a part of the forest cover has been cut.

Since the establishment of the station the gage datum has not been changed, although the gage has washed out several times. It was replaced as soon as practicable afterwards, but there still remain intervals when the gage heights were estimated and on this account low-water estimates are impossible.

Discharge measurements of Molalla River near Molalla, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 23	J. C. Stevens	105	129	1.00	76
October 3	E. F. Kreigsman	105	160	1.45	177
1908.					
September 29 [a]	H. D. McGlashan	106	104	.94	61

[a] Measured by wading at same section.

Daily gage height, in feet, of Molalla River near Molalla, Oreg., for 1907 and 1908.

[Raymond Dickey, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.95	6.1	3.5	3.3	2.6	1.8	1.6	.....	.....	1.4	1.6	3.2
2	2.8	5.0	3.4	3.3	2.5	1.7	1.7	.....	.....	1.5	1.9	3.1
3	9.0	8.0	3.3	3.2	2.4	1.7	2.0	.....	.....	1.5	1.8	3.0
4	7.5	9.8	3.2	3.2	2.4	1.7	1.8	.....	.....	1.45	1.6	3.0
5	5.6	[a] 11.0	3.0	3.3	2.3	1.7	1.7	.....	.....	1.4	1.5	3.2
6	4.5	[a] 8.8	2.9	4.2	2.3	1.6	1.6	.....	.....	.....	1.4	3.3
7	4.1	[a] 7.2	3.0	8.3	2.3	1.7	1.5	.....	.....	.....	.....	3.8
8	3.65	[a] 6.2	3.2	6.2	2.2	1.8	1.4	.....	.....	.....	.....	3.7
9	3.4	[a] 5.3	3.3	5.3	2.2	1.8	1.4	.....	.....	.....	.....	4.0
10	3.2	[a] 4.4	3.5	5.5	2.5	1.8	.....	.....	.....	.....	.....	3.8
11	3.0	3.6	3.5	4.7	2.4	1.9	.....	.....	.....	.....	.....	3.7
12	2.8	3.4	3.55	4.2	2.3	2.0	.....	.....	.....	.....	.....	4.2
13	2.7	3.3	3.4	4.2	2.3	2.0	.....	.....	.....	.....	.....	4.1
14	2.45	3.1	3.0	4.0	2.5	2.1	.....	.....	.....	.....	1.5	4.0
15	2.3	3.0	3.2	3.8	2.5	2.1	.....	.....	.....	.....	1.5	3.9
16	2.25	2.9	3.4	3.5	2.4	2.2	.....	.....	1.8	.....	1.4	3.8
17	2.25	2.7	3.4	3.3	2.4	2.1	.....	.....	1.7	.....	1.4	3.6
18	2.3	2.6	3.5	4.4	2.4	2.1	.....	.....	1.5	.....	1.4	3.5
19	2.2	2.9	3.8	5.1	2.4	2.0	.....	.....	.....	.....	.....	3.6
20	2.3	3.0	4.0	4.4	2.3	1.9	.....	.....	.....	.....	2.8	3.8
21	2.25	3.0	3.8	4.0	2.3	1.8	.....	.....	.....	.....	2.6	5.5
22	2.35	3.0	3.6	3.8	2.2	1.9	.....	.....	.....	.....	2.4	7.2
23	2.3	3.1	3.4	3.7	2.2	2.0	.....	1.0	.....	.....	2.5	6.5
24	2.5	3.6	3.1	3.5	2.1	1.9	.....	.....	.....	.....	7.45	6.8
25	2.45	3.8	2.9	3.3	2.0	1.8	.....	1.6	.....	.....	6.0	7.5
26	2.5	3.7	2.8	3.1	2.0	1.8	.....	1.4	.....	.....	5.4	7.8
27	2.7	3.6	2.8	2.9	1.9	1.7	.....	.....	.....	.....	4.5	6.5
28	4.3	3.6	2.9	2.8	1.9	1.7	.....	.....	.....	.....	4.0	5.6
29	5.4	.....	3.0	2.7	1.8	1.6	.....	.....	.....	.....	3.6	4.9
30	5.4	.....	3.1	2.7	1.8	1.6	.....	.....	.....	1.5	3.3	4.0
31	7.0	.....	3.3	.....	1.8	.....	.....	.....	.....	1.5	.....	3.6
1908.												
1	3.4	2.3	2.4	3.2	3.0	3.2	2.3	.....	1.6	.95	3.0	2.4
2	3.3	2.2	2.4	3.3	3.0	3.2	2.3	.....	1.5	1.15	2.6	2.3
3	3.3	2.3	2.4	3.4	3.0	3.1	2.2	.....	.....	1.15	2.3	2.2
4	3.2	2.4	2.3	3.4	2.9	3.1	2.1	.....	.....	1.05	2.1	2.1
5	3.2	3.4	2.3	3.3	2.8	3.0	2.0	.....	.....	1.05	2.0	2.1
6	3.3	4.5	2.3	3.1	2.8	2.9	2.0	.....	.....	1.05	1.9	2.0
7	3.3	4.0	2.2	3.0	2.8	3.0	1.9	.....	.....	.95	1.8	2.0
8	3.6	3.8	2.2	2.8	3.0	3.0	1.8	.....	.....	.95	1.7	1.9
9	4.4	3.6	2.2	2.7	3.0	2.9	1.7	.....	.....	.95	1.7	1.9
10	4.3	3.5	2.4	2.9	2.9	2.8	1.6	.....	.....	.95	1.6	1.8
11	4.2	3.2	2.5	3.1	3.0	2.8	1.5	.....	.....	.95	1.5	1.8
12	3.9	3.0	2.7	3.3	3.2	2.7	1.5	.....	.....	.95	1.5	2.0
13	3.7	2.8	2.9	3.3	3.0	2.6	1.5	.....	.....	1.15	1.4	3.0
14	3.5	2.7	4.9	3.2	3.0	2.4	1.4	.....	.....	2.8	1.4	2.8
15	3.4	2.7	10.0	3.2	3.4	2.3	1.4	.....	.....	2.6	1.4	2.6
16	3.3	2.7	7.5	3.1	4.4	2.2	.....	.....	.....	2.5	1.4	2.4
17	3.5	2.7	5.6	3.3	4.0	2.1	.....	.....	.....	2.3	1.4	2.2
18	3.4	2.8	4.8	4.6	4.5	2.3	.....	.....	.....	2.3	3.3	2.1
19	3.6	2.7	3.9	4.4	4.3	2.7	.....	.....	.....	2.4	2.6	2.0
20	4.4	2.6	3.5	4.1	4.1	3.2	.....	.....	.....	2.6	3.8	1.9
21	4.0	2.6	3.4	4.0	3.8	3.1	.....	.....	.....	2.4	4.2	1.8
22	3.8	2.5	3.3	3.9	3.6	3.0	.....	.....	.....	2.2	4.9	1.9
23	3.6	2.5	3.3	3.8	3.4	2.8	.....	.....	.....	2.0	4.2	1.9
24	3.5	2.4	3.3	5.4	3.4	2.7	.....	.....	.....	1.9	4.0	2.1
25	3.3	2.4	3.5	4.4	3.3	2.5	.....	.....	.....	1.8	3.6	3.3
26	3.0	2.3	3.3	3.9	3.3	2.7	.....	.....	.....	1.7	3.0	4.1
27	2.9	2.3	3.2	3.5	3.2	2.6	.....	.....	.....	1.7	2.8	4.3
28	2.8	2.4	3.3	3.2	3.1	2.5	.....	.....	.....	1.6	2.6	4.5
29	2.6	2.5	3.3	3.0	3.1	2.4	.....	.....	.....	1.6	2.5	4.2
30	2.5	.....	3.2	3.0	3.2	2.4	.....	2.0	.95	3.1	2.5	3.7
31	2.4	.....	3.2	.....	3.2	.....	.....	1.8	.....	3.7	.....	3.4

[a] Gage heights February 5 to 10 have been estimated by comparison with those at other stations.

NOTE.—All omitted gage heights for 1907-8 were below 1.4 feet. The gage could not be read below this point and the observer estimated the stage. It was found that he made errors of 0.1 foot more or less, according to stages, in making these readings.

Rating tables for Molalla River near Molalla, Oreg.

NOVEMBER 1, 1905, TO JANUARY 31, 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	565	3.60	1,510	5.00	2,810	6.80	4,735
2.30	620	3.70	1,595	5.10	2,910	7.00	4,955
2.40	675	3.80	1,680	5.20	3,015	7.20	5,185
2.50	735	3.90	1,770	5.30	3,120	7.40	5,415
2.60	795	4.00	1,860	5.40	3,225	7.60	5,645
2.70	855	4.10	1,950	5.50	3,330	7.80	5,875
2.80	920	4.20	2,040	5.60	3,435	8.00	6,105
2.90	985	4.30	2,130	5.70	3,540	8.20	6,345
3.00	1,055	4.40	2,225	5.80	3,645	8.40	6,585
3.10	1,125	4.50	2,320	5.90	3,750	8.60	6,825
3.20	1,200	4.60	2,415	6.00	3,855	8.80	7,065
3.30	1,275	4.70	2,510	6.20	4,075	9.00	7,305
3.40	1,350	4.80	2,610	6.40	4,295	10.00	8,550
3.50	1,430	4.90	2,710	6.60	4,515	11.00	9,800

FEBRUARY 1, 1907, TO DECEMBER 31, 1908.[b]

1.00	72	1.70	268	2.40	635	3.10	1,100
1.10	90	1.80	312	2.50	695	3.20	1,180
1.20	112	1.90	359	2.60	760	3.30	1,260
1.30	137	2.00	409	2.70	825	3.40	1,340
1.40	165	2.10	461	2.80	890	3.50	1,425
1.50	196	2.20	515	2.90	960	3.60	1,510
1.60	231	2.30	575	3.00	1,030		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based upon 6 discharge measurements made during 1905–6 and is well defined between gage heights 0.75 foot and 4.0 feet.

[b] This table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1907–8 and is well defined between gage heights 0.9 foot and 1.5 feet. Above gage height 3.6 feet it is the same as the 1907 table.

Monthly discharge of Molalla River near Molalla, Oreg., for 1907 and 1908.

[Drainage area, 220 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	7,300	565	1,680	7.64	8.81	103,000	B.
February	9,800	760	2,660	12.1	12.60	148,000	C.
March	1,860	890	1,250	5.68	6.55	76,900	A.
April	6,460	825	1,920	8.73	9.74	114,000	B.
May	760	312	548	2.49	2.87	33,700	A.
June	515	231	339	1.54	1.72	20,200	A.
July	409	.....	125	.568	.65	7,690	C.
August	231	.....	75	.341	.39	4,610	D.
September	312	.....	110	.500	.56	6,550	D.
October	196	.....	140	.637	.73	8,610	D.
November	5,470	.....	862	3.92	4.37	51,300	A.
December	5,880	1,030	2,370	10.8	12.45	146,000	B.
The year	9,800	.....	1,010	4.58	61.44	721,000	
1908.							
January	2,220	635	1,390	6.32	7.29	85,500	A.
February	2,320	515	938	4.26	4.59	54,000	A.
March	8,550	515	1,550	7.05	8.13	95,300	A.
April	3,220	825	1,440	6.55	7.31	85,700	A.
May	2,320	890	1,290	5.86	6.76	79,300	A.
June	1,180	461	860	3.91	4.36	51,200	A.
July	575	.....	210	.955	1.10	12,900	C.
August	409	.....	70	.318	.37	4,300	D.
September	231	.....	85	.386	.43	5,060	D.
October	1,600	64	381	1.73	1.99	23,400	A.
November	2,710	165	794	3.61	4.03	47,200	A.
December	2,320	312	787	3.58	4.13	48,400	A.
The year	8,550	.....	816	3.71	50.49	592,000	

NOTE.—Low-water discharge below 165 second-feet for July to November, 1907, and July to September 1908, estimated and intercompared with the discharge of Clackamas and North Fork of Santiam rivers. The mean values given are subject to large errors and are merely given for the purpose of showing in a rough way the relatively low flow at this station as compared with other adjacent streams at extreme low stages.

CLACKAMAS RIVER AT ESTACADA, OREG.

This station was established April 6, 1908, and replaces the station formerly maintained at Barton. It is located on the Oregon Water Power Company's park at Estacada, about 1¾ miles downstream from the Portland Railway Light and Power Company's hydroelectric plant at Cazadero. The river at this point flows in a deep canyon, and it was impossible to find a site which should combine proper gaging facilities with easy accessibility. It was therefore necessary to install two gages. The upper gage—No. 1—on which daily readings are made, is located at the foot of a stairway leading to the water's edge opposite the dance hall in the park. The cable from which measurements are made is located about one-fourth mile downstream from this point, where gage No. 2 was installed. All measurements have been referred to both gages, and a rating curve has been developed for each. Between the two gages there is a small amount of inflow from springs, the larger being from the left bank just above the gaging site. The flow of these springs, however, is hardly over 1 per cent of the flow of the stream at extreme low water and need not be given consideration.

The non-uniform use of the water at the power plant causes daily fluctuations in the quantity of water passing the gaging station. This fluctuation is very noticeable at low water, nearly disappears at medium stage, and is eliminated at high water.

Discharge measurements of Clackamas River at Estacada, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				No. 2.	No. 1.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
April 6	J. C. Stevens	164	920	2.30	5.58	2,890
July 13	H. D. McGlashan	148	761	1.20	4.22	1,410
August 15	L. R. Allen	143	667	.84	3.84	1,030
September 26	Stevens and Post	144	642	.62	3.60	877

Daily gage heights of Clackamas River at Estacada, Oreg., for 1908.

[N. L. S. Laurry, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					6.65	6.18	5.00	3.70	3.95	3.62	5.60	4.90
2					6.52	6.38	4.90	3.70	3.90	3.80	5.10	4.80
3					6.35	6.10	4.80	3.70	3.85	3.60	4.98	4.75
4					6.20	6.00	4.75	3.65	3.80	3.58	4.55	4.78
5					6.20	5.92	4.60	3.72	3.78	3.60	4.60	4.80
6				5.55	6.18	5.85	4.52	3.75	3.75	3.62	4.30	4.18
7				5.45	6.42	6.05	4.42	3.75	3.75	3.62	4.30	4.80
8				5.38	6.25	5.95	4.38	3.65	3.95	3.68	4.02	4.78
9				5.48	6.15	6.35	4.35	3.62	3.85	3.65	4.20	4.65
10				5.50	5.82	6.22	4.35	3.62	3.80	3.45	4.00	4.55
11				5.60	5.98	6.15	4.25	3.58	3.80	3.50	4.10	4.60
12				6.20	5.72	6.10	4.20	3.65	3.78	3.65	4.10	5.00
13				6.20	5.62	5.85	4.20	3.65	3.52	3.90	4.20	5.50
14				6.18	5.68	5.65	4.48	3.70	3.75	5.15	4.25	5.42
15				6.25	6.00	5.75	4.22	3.60	3.75	5.22	3.60	5.20
16				6.18	6.42	5.70	4.22	3.85	4.00	4.60	4.10	4.92
17				6.80	6.22	5.48	4.15	3.90	3.75	4.45	4.05	4.88
18				8.42	6.70	5.55	4.10	3.85	3.70	4.20	4.90	4.80
19				8.62	6.75	5.88	4.00	3.90	3.65	4.45	5.00	4.55
20				8.15	6.50	5.72	4.00	3.92	3.60	5.22	5.30	4.35
21				7.55	6.30	5.80	4.00	3.88	3.68	4.55	5.95	4.75
22				7.02	6.08	5.65	3.95	3.88	3.60	4.35	7.30	4.65
23				6.70	6.18	5.45	3.92	3.75	3.65	4.40	7.00	4.90
24				8.65	6.02	5.32	3.90	3.75	3.62	4.28	6.40	5.15
25				8.15	6.28	5.22	3.90	3.90	3.55	4.20	5.90	4.45
26				7.32	5.90	5.20	3.40	3.85	3.55	4.38	5.30	6.10
27				7.00	5.80	5.38	3.85	3.80	3.62	4.30	5.25	5.80
28				6.62	5.98	5.15	3.88	4.05	3.75	4.25	5.00	6.55
29				6.45	6.02	5.02	3.82	4.28	3.60	4.30	4.78	6.65
30				6.45	6.02	5.02	3.90	3.82	3.55	4.85	4.98	6.12
31					6.02		3.80	3.95		6.50		5.80

Rating table for Clackamas River at Estacada, Oreg., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	733	4.60	1,740	5.80	3,130	7.00	4,940
3.50	796	4.70	1,845	5.90	3,260	7.20	5,280
3.60	864	4.80	1,950	6.00	3,400	7.40	5,620
3.70	936	4.90	2,055	6.10	3,540	7.60	5,980
3.80	1,015	5.00	2,160	6.20	3,690	7.80	6,340
3.90	1,095	5.10	2,270	6.30	3,840	8.00	6,710
4.00	1,180	5.20	2,385	6.40	3,990	8.20	7,100
4.10	1,265	5.30	2,500	6.50	4,140	8.40	7,500
4.20	1,355	5.40	2,620	6.60	4,300	8.60	7,900
4.30	1,445	5.50	2,740	6.70	4,460		
4.40	1,540	5.60	2,870	6.80	4,620		
4.50	1,640	5.70	3,000	6.90	4,780		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 8 discharge measurements made during 1908–9 and is well defined.

Monthly discharge of Clackamas River at Estacada, Oreg., for 1908.

Month.	Discharge in second-feet.			Run-off in acre-feet.	Accuracy.
	Maximum.	Minimun.	Mean.		
April 6-30	8,000	2,600	4,610	228,000	A.
May	4,540	2,900	3,640	224,000	A.
June	3,960	2,180	3,070	183,000	A.
July	2,160	733	1,370	84,200	A.
August	1,430	850	1,010	62,100	A.
September	1,180	810	963	57,300	A.
October	4,140	764	1,440	88,500	A.
November	5,450	864	2,160	129,000	A.
December	4,380	1,340	2,330	143,000	A.
The period				1,200,000	

CLACKAMAS RIVER NEAR BARTON, OREG.

This station was established October 2, 1905, and was maintained until superseded by the station at Estacada, established April 6, 1908. It is located on the farm of H. Breithaupt, 3 miles west of Barton and 1.5 miles below the mouth of Deep Creek, in sec. 20, T. 2 S., R. 3 E.

This stream is particularly valuable for its water power, and in this connection the records of flow have been invaluable. They are also of great scientific interest, as they furnish data concerning the run-off from heavily forested areas, and will be extensively used in the general study of the water supply of the Willamette River system.

The river never freezes at this point, and the records are believed to be fairly reliable. The river, however, is subject to heavy floods, which have caused damage to gages and gaging equipment, so that during the year 1907 no measurements were obtained, although the gage-height records are complete. Gage-height records were continued until the close of the year 1908 in order to obtain a comparison between the gages at Estacada and Barton. One measurement was made during the summer of 1908 to determine the applicability of the rating of 1906 to later gage heights.

The following measurement was made September 26, 1908, from a boat 150 feet above the former cable section:

Width, 137 feet; area, 311 square feet; gage height, 2.61 feet; discharge, 816 second-feet.

Daily gage height, in feet, of Clackamas River near Barton, Oreg., for 1907 and 1908.

[H. Breitbaubt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.7	10.2	5.1	4.8	4.6	3.8	3.3	2.8	2.5	3.0	2.5	4.6
2	5.6	8.1	5.0	4.8	4.5	3.7	3.3	3.1	2.5	2.7	3.0	4.3
3	5.8	7.8	4.9	4.6	4.4	3.7	3.7	2.9	2.6	2.8	2.7	4.3
4	10.45	12.55	4.7	4.5	4.5	3.8	3.2	2.8	2.6	2.6	2.9	4.0
5	9.15	16.5	4.6	4.7	4.6	3.7	3.2	2.8	2.5	2.4	2.3	4.1
6	7.2	14.0	4.5	5.2	4.5	3.7	3.2	2.7	2.5	2.5	2.4	4.1
7	7.0	11.0	4.5	9.75	4.5	3.6	3.2	2.8	2.5	2.5	2.4	4.4
8	6.1	10.0	4.4	9.2	4.5	3.5	3.1	2.9	2.5	2.6	2.4	4.8
9	5.6	9.0	4.4	7.6	4.7	3.4	3.1	2.9	2.5	2.6	2.3	5.0
10	5.4	8.0	4.5	8.1	4.9	3.5	3.1	2.9	2.6	2.5	2.3	5.0
11	5.3	7.0	4.6	7.0	4.8	3.5	3.3	2.9	2.6	2.5	2.3	5.2
12	5.2	6.5	4.5	6.3	4.8	3.7	3.3	2.8	2.6	2.5	2.4	5.6
13	5.1	6.3	4.5	6.0	4.6	3.8	3.2	2.8	2.5	2.5	2.3	9.5
14	4.7	6.0	4.5	6.0	4.5	3.8	3.2	2.7	2.5	2.5	2.2	7.5
15	4.7	5.7	4.4	5.8	4.6	3.7	3.2	2.6	2.5	2.4	2.2	6.0
16	4.7	5.5	4.2	5.6	4.7	3.7	3.1	2.6	2.5	2.3	2.2	5.5
17	4.5	5.4	4.2	5.5	4.6	3.8	3.1	2.5	3.1	2.4	2.2	4.9
18	4.5	5.2	4.9	5.6	4.6	3.7	3.0	2.5	2.9	2.3	2.3	4.7
19	4.6	5.0	4.8	7.8	4.5	3.6	2.9	2.5	2.7	2.3	2.5	4.4
20	4.6	5.1	4.8	7.2	4.5	3.5	3.0	2.6	2.6	2.3	3.4	4.6
21	4.6	5.1	4.9	6.2	4.5	3.5	3.0	2.6	2.5	2.5	3.7	4.8
22	4.5	5.1	4.6	5.9	4.4	3.6	2.9	2.6	2.5	2.4	4.0	11.5
23	4.6	5.1	4.7	5.7	4.3	3.7	2.9	2.5	2.5	2.4	4.8	11.4
24	4.6	5.5	4.6	5.5	4.2	3.7	2.9	2.5	2.5	2.4	8.5	11.2
25	4.6	5.7	4.6	5.3	4.2	3.6	2.8	2.9	2.5	2.4	10.6	9.0
26	4.5	5.5	4.3	5.0	3.9	3.5	2.8	2.8	2.6	2.3	8.2	11.95
27	4.5	5.3	4.3	4.9	4.0	3.5	3.0	2.6	2.6	2.3	6.3	10.5
28	5.2	5.1	4.2	4.8	4.1	3.4	2.9	2.6	2.9	2.4	5.7	8.0
29	7.0	.....	4.2	4.7	3.8	3.4	2.9	2.5	2.7	2.4	5.4	6.7
30	7.7	.....	4.4	4.6	4.0	3.4	3.0	2.5	2.5	2.6	5.0	6.1
31	9.0	.....	4.5	.....	4.0	.....	2.9	2.5	.....	2.5	.....	5.9
1908.												
1	5.4	3.9	4.1	4.9	5.1	5.1	3.8	2.9	2.7	2.6	4.4	3.3
2	5.2	3.7	4.1	5.0	5.2	5.0	3.8	2.8	2.7	2.7	4.4	3.1
3	5.1	3.5	4.0	5.0	5	4.7	3.7	2.8	2.7	2.8	4.3	3.1
4	5.0	3.8	4.0	4.9	4.9	4.7	3.7	2.8	2.8	2.9	3.8	3.0
5	5.0	3.9	4.0	4.8	4.6	4.8	3.6	2.7	2.8	2.3	3.4	3.0
6	5.2	5.4	3.9	4.8	4.9	4.6	3.5	2.7	2.8	2.4	3.2	2.8
7	5.1	5.4	3.8	4.5	.....	4.8	3.5	2.7	2.8	2.6	3.1	2.8
8	4.9	5.0	3.7	4.4	.....	4.8	3.4	2.7	2.7	2.6	3.0	3.0
9	6.1	4.7	3.7	4.4	.....	4.9	3.4	2.6	2.7	2.7	2.9	2.9
10	5.7	4.5	3.7	4.5	.....	4.9	3.3	2.6	2.6	2.7	2.9	2.8
11	6.1	4.3	3.8	4.5	.....	4.8	3.3	2.7	2.6	2.7	2.8	3.0
12	5.8	4.1	3.9	4.6	.....	4.7	3.3	2.8	2.6	2.7	2.7	3.2
13	5.5	4.0	4.5	4.6	.....	4.6	3.3	2.8	2.5	2.9	2.7	4.3
14	5.3	4.2	5.8	4.6	.....	4.4	3.4	2.9	2.5	3.0	2.7	3.5
15	5.0	4.0	14.0	4.7	.....	4.3	3.3	2.8	2.6	4.1	2.6	3.8
16	4.8	4.0	13.0	4.7	.....	4.2	3.3	2.7	2.6	3.6	2.7	3.7
17	5.2	4.1	9.8	4.9	.....	4.2	3.2	2.7	2.5	3.4	2.7	3.6
18	5.0	4.3	8.0	6.5	.....	4.4	3.2	2.7	2.5	3.3	3.1	3.5
19	5.1	4.3	6.9	7.3	.....	4.6	3.1	2.7	2.4	3.1	3.8	3.6
20	6.7	4.2	6.2	6.8	.....	4.6	3.1	2.7	2.4	4.1	3.7	3.4
21	6.1	3.9	5.8	6.2	.....	4.5	3.1	2.6	2.5	3.7	4.3	3.5
22	5.6	3.8	5.3	5.8	.....	4.4	3.1	2.5	2.4	3.4	5.2	3.4
23	5.3	3.7	5.0	5.8	.....	4.4	3.0	2.5	2.4	3.4	6.6	3.2
24	5.0	4.0	5.2	6.7	.....	4.3	3.0	2.6	2.4	3.1	5.8	4.0
25	4.6	4.0	5.4	6.5	.....	4.2	3.0	3.1	2.5	3.2	5.1	3.8
26	4.4	3.9	5.2	6.3	.....	4.1	3.0	2.8	2.5	3.1	4.0	5.7
27	3.9	4.0	5.2	5.7	.....	4.1	3.0	2.6	2.9	3.0	3.9	4.9
28	4.4	4.0	4.9	5.5	.....	4.1	3.0	2.7	2.8	3.0	3.8	5.0
29	4.1	3.9	4.7	5.3	.....	4.0	3.0	3.1	2.7	3.1	3.8	5.8
30	4.3	.....	5.1	5.1	.....	3.9	2.9	3.0	2.7	3.2	3.5	5.1
31	3.9	.....	4.9	.....	.....	.....	2.9	2.8	.....	5.6	.....	4.7

Rating tables for Clackamas River near Barton, Oreg.

1905 TO 1907.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	600	3.90	2,450	5.60	5,790	8.60	14,290
2.30	670	4.00	2,610	5.70	6,030	8.80	14,910
2.40	740	4.10	2,780	5.80	6,270	9.00	15,530
2.50	810	4.20	2,950	5.90	6,510	9.20	16,170
2.60	890	4.30	3,120	6.00	6,760	9.40	16,810
2.70	970	4.40	3,300	6.20	7,270	9.60	17,450
2.80	1,060	4.50	3,480	6.40	7,790	9.80	18,090
2.90	1,190	4.60	3,670	6.60	8,330	10.00	18,730
3.00	1,260	4.70	3,860	6.80	8,890	11.00	22,030
3.10	1,370	4.80	4,050	7.00	9,460	12.00	25,430
3.20	1,480	4.90	4,250	7.20	10,040	13.00	28,900
3.30	1,600	5.00	4,460	7.40	10,620	14.00	32,500
3.40	1,730	5.10	4,670	7.60	11,220	15.00	36,200
3.50	1,860	5.20	4,890	7.80	11,820	16.00	40,000
3.60	2,000	5.30	5,110	8.00	12,430	17.00	43,900
3.70	2,140	5.40	5,330	8.20	13,050		
3.80	2,290	5.50	5,560	8.40	13,670		

1908.[b]

2.20	540	2.60	820	3.00	1,210	3.40	1,720
2.30	600	2.70	900	3.10	1,330	3.50	1,860
2.40	670	2.80	1,000	3.20	1,450		
2.50	740	2.90	1,100	3.30	1,580		

[a] This table is not applicable for ice or obstructed-channel conditions. It is based on seven discharge measurements made during 1905–6, and is well defined between gage heights 2.5 feet and 5.5 feet.

[b] This table is not applicable for ice or obstructed-channel conditions. It is based on one discharge measurement made during 1908 and earlier measurements, and is well defined between gage heights 2.6 feet and 5.5 feet. Above gage height 3.5 feet it is the same as the 1905–7 table.

Monthly discharge of Clackamas River near Barton, Oreg., for 1907 and 1908.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	20,200	3,480	6,420	8.02	9.25	395,000	B.
February	42,000	4,460	11,400	14.2	14.79	633,000	B.
March	4,670	2,950	3,600	4.50	5.19	221,000	A.
April	17,900	3,480	6,950	8.69	9.70	414,000	B.
May	4,250	2,290	3,370	4.21	4.85	207,000	A.
June	2,290	1,730	2,030	2.54	2.83	121,000	A.
July	2,140	1,060	1,360	1.70	1.96	83,600	A.
August	1,370	810	981	1.23	1.42	60,300	A.
September	1,370	810	884	1.10	1.23	52,600	A.
October	1,260	670	801	1.00	1.15	49,300	A.
November	20,700	600	3,200	4.00	4.46	190,000	A.
December	25,300	2,610	8,710	10.9	12.57	536,000	B.
The year	42,000	600	4,140	5.17	69.40	2,960,000	
1908.							
January	8,610	2,450	4,810	6.01	6.93	296,000	A.
February	5,330	1,860	2,910	3.64	3.93	167,000	A.
March	32,500	2,140	6,460	8.08	9.32	397,000	B.
April	10,300	3,300	5,270	6.59	7.35	314,000	A.
May[a]			4,150	5.19	5.98	255,000	B.
June	4,670	2,450	3,510	4.39	4.90	209,000	A.
July	2,290	1,100	1,550	1.94	2.24	95,300	A.
August	1,330	740	953	1.19	1.37	58,600	A.
September	1,100	670	834	1.04	1.16	49,600	A.
October	5,790	600	1,470	1.84	2.12	90,400	A.
November	8,330	820	2,360	2.95	3.29	140,000	A.
December	6,270	1,000	2,290	2.86	3.30	141,000	A.
The year	32,500	600	3,050	3.81	51.89	2,210,000	

[a] Discharges for May obtained by increasing those at Estacada 14 per cent.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Willamette River drainage basin during 1907 and 1908:

Miscellaneous measurements in Willamette River drainage basin, Oregon, 1907–8.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
February 8, 1907	Willamette River	Columbia River	Morrison Street Bridge, Portland.	[a] 22.3	243,000
September 23, 1908	Mohawk River	McKenzie River	Marcola, temporary footbridge.	[b] −2.25	41
September 15, 1908	Long Tom River	Willamette River	Goodman's ranch, 2 miles above Monroe.	[cd] −5.30	22
September 14, 1908	Marys River	do	2 miles below Philomath.	[c] −0.50	20
August 16, 1908	Woods Creek	do	Philomath, near mouth.	([c])	.6
August 16, 1907	Muddy River (South Fork of Marys).	do	do	([c])	8.6
September 16, 1908	do	do	4 miles below Philomath.	[ce] −3.02	12
August 16, 1907	North Fork of Marys River.	Marys River	Philomath, near mouth.	([c])	11
September 14, 1908	Oak Creek	do	Corvallis, near mouth	([c])	[f] 2
September 18, 1908	Muddy Creek	Willamette River	1 mile west of Shedd's	([c])	[f] 2
Do	Callapooya River	do	3 miles south of Tangent.	[cg] −2.92	33
September 17, 1908	Slaughter House Creek.	Callapooya River	Albany, near mouth	([c])	[f] 5
Do	Fisher Creek	do	do	([c])	[f] 5
September 18, 1908	Oak Creek	do	do		0
July 27, 1907	North Fork of Santiam River.	Santiam River	Detroit, ¼ mile above Marion Fork.		165
July 26, 1907	Woodpecker Creek.	do	Detroit near mouth		[f] 2
July 27, 1907	Marion Fork of Santiam River.	North Fork of Santiam River.	Fish Lake trail crossing.		207
Do	Minto Creek	Santiam River	Detroit, Minto trail crossing.		18
July 26, 1907	Boulder Creek	North Fork of Santiam River.	Detroit		[f] 10
July 24, 1907	Breitenbush Creek.	do	Detroit, 1,000 feet above mouth.		222
September 10, 1908	Rickreal (La Creole) River.	Willamette River	Dallas	([c])	[f] 3
September 11, 1908	do	do	Rickreal, below Muddy River.	([c])	10
September 10, 1908	Dallas Mill canal	Rickreal River	Dallas		6.5
September 8, 1908	North Fork of Yamhill River.	Yamhill River	La Fayette	([c i])	20
October 7, 1908	South Fork of Yamhill River.	do	Whiteson	[cj] −49.35	45
July 30, 1907	Mill waste	South Fork of Yamhill River.	Sheridan		11
September 30, 1908	Silver Creek	Pudding River	¼ mile above Silverton	[ch] −6.98	10
October 18, 1907	Clackamas River	Willamette River	Gladstone		686
October 8, 1907	do	do	Cazadero, between dam and power house.		230
August 2, 1907	P. Ry. L. & P. Co.'s power canal.	Clackamas River	Cazadero, flume above forebay.		610
Do	Wasteway from P. Ry. L. & P. Co.'s canal.	do	Cazadero, below penstocks.		50
August 1, 1907	Eagle Creek	do	Sec. 10, T. 3 S., R. 4 E		34
June 26, 1907	Tualitin River	Willamette River	Forest Grove		94
September 25, 1907	do	do	Willamette, 3 miles above mouth.		135
June 26, 1907	Gales Creek	Tualitin River	Forest Grove		40
June 25, 1907	Dairy Creek	do	Greeneville		19

[a] Flood stage.
[b] Below 20-penny spike in stream face of maple root on right bank, 30 feet below highway bridge.
[c] Low water.
[d] Below 8-penny nail in upstream side of overhanging ash tree on left bank, 100 feet below ford.
[e] Below bent 10-penny nail in downstream face of sixth pile, right end of bridge, downstream side.
[f] Estimated.
[g] Below 8-penny nail in downstream face of first pile in right abutment, downstream side.
[h] Below 8-penny nail in large root of stump on right bank at gaging station.
[i] Made 5 miles above mouth.
[j] Made at highway bridge. Water surface 49.35 feet below top of head of eye bar, second panel from right end of bridge, downstream side.

HYDRO-ELECTRIC PLANT ON PUYALLUP RIVER NEAR ELECTRON, WASH.

Developing 26,600 horsepower.

PUGET SOUND DRAINAGE BASIN.

DESCRIPTION.

The drainage of the western slope of the Cascade Mountains in Washington is to Puget Sound. The most important streams are Nisqually River, which drains the southern portion of Mount Rainier; Puyallup River, which drains the northern and western portion of Mount Rainier; White River, which drains the northern and eastern portion of Mount Rainier; Green River, the canyon of which is occupied by the Northern Pacific Railway; Cedar River, from which the city of Seattle draws its water supply; Snoqualmie River; Skykomish River, whose canyon is occupied by the Great Northern Railway; Stillagaumish River; and Skagit River, which drains the territory between Mount Baker and the main summit of the Cascade Range.

Comparatively little is known concerning the run-off and other hydrographic characteristics of these streams. They are capable of furnishing enormous quantities of water power (Pl. IX), as the fall is great, and the flow generally well sustained during the summer months. The area is perhaps one of the most densely forested sections of the United States, a large portion of the headwaters of all the streams being included within the boundaries of national forests.

The mean annual rainfall of this area varies greatly from point to point. Puget Sound has long been noted for its excessive rainfall, yet in the very midst of this area of abundant precipitation is found a small section that is almost semiarid. The mean annual rainfall at Olympia is 55 inches, at Tacoma 47, at Seattle 36. West of Seattle, on Hood canal, the precipitation is 76 inches per annum, while 35 miles to the north, at Port Townsend, the precipitation is only 21 inches. Across Admiralty Strait from Port Townsend the rainfall is 23 inches. The country adjacent to Port Townsend lies to the northeast of the Olympic Mountains in the path of the prevailing winds of the southwest, but the winds are deprived of a large part of their moisture before Port Townsend is reached. Northeastward the precipitation gradually increases again, and at Marble Mount it is 47 inches per annum. The only reliable records of precipitation near the summit of the Cascades have been obtained at Snoqualmie Falls, where, at an elevation of 438 feet, the precipitation is 60 inches. It is probable that on the summit of the Cascades the annual precipitation is 120 inches or more. A large part of the precipitation in this portion of the country falls during the nine months from September to May. On the summit of the Cascades it is mostly snowfall. Snow deposits during a single winter frequently aggregate 40 feet or more. When these snows disappear in the spring, high waters may be expected in all streams draining these mountains. The regular spring run-off, however, is rarely high enough to do a great amount of damage, as the

streams are very steep and carry the water away rapidly. Climatic influences, however, frequently combine to cause very destructive floods. These usually occur in the fall after the first heavy snowfall, and are caused by "chinook" winds from the southwest when accompanied by rain. These winds are annual occurrences, but only when they follow a heavy precipitation of early snow do they cause damaging floods. The highest flood from this cause occurred November 14 to 17, 1906.

The only complete records of run-off are those obtained on Cedar River. From these records it appears that the year 1905 was an exceptionally low year as far as run-off was concerned, and 1903 a wet year.

The following gaging stations have been maintained in this basin:

White River near Buckley (1899 to 1902).
Cedar River at Ravensdale (1902 to 1908).
Cedar River at Cedar Lake (1902 and 1903).
Cedar River near Seattle (1895 to 1898).
Snoqualmie River at Snoqualmie Falls (1902 to 1906).
Stillaguamish River near Robe (1902 and 1903).
South Fork of Skykomish River at Index (1902 to 1905).

CEDAR RIVER NEAR RAVENSDALE, WASH.

This station was established September 27, 1902. It is located at the intake of the pipe line which furnishes water to the city of Seattle. It is 15 miles below Clear Lake and 3 miles north of Ravensdale.

The data obtained at this station are of great value, as they are continuous and reliable and constitute practically the only stream flow data on the western slope of the Cascade Range in Washington. The flow is obtained from the formula $Q=3.75lh^{3/2}+35$. The gage heights represent the head of water (h) on the crest of the dam. The length of the crest (l) is 120 feet. It is steel shod, of triangular section. The upstream slope forms an angle of 30 degrees with the horizontal and the downstream slope an angle of 60 degrees. For this dam a mean of the coefficient obtained from the current meter measurements made from 1902 to 1906 gives a value of $c=3.76$, while the mean obtained from a set of weir experiments for a dam of similar type is approximately 3.73. (See Water Supply Paper 200, Pl. X, series 140.) In computing the rating table "c" has been given the value of 3.75. The quantity 35 is added as the amount diverted into the pipe line. This diversion varies within small limits, but 35 second-feet has been used throughout. (For a description of the measurement of the amount diverted see Trans. Am. Soc. Civil Eng., vol. 49, p. 112.) The datum of the gage is the elevation of the crest of the dam—436 feet above sea level, and has not been altered since it was established. The results are reasonably accurate.

Daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1907 and 1908.

[George Landsburg, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.36	1.74	1.78	1.11	1.26	1.41	0.91	0.62	0.70	0.61	0.67	.....
2	1.29	1.63	1.68	1.10	1.23	1.35	.92	.62	.73	.62	.68	.....
3	1.35	1.53	1.58	1.11	1.20	1.22	.96	.61	.71	.61	.71	.....
4	1.52	1.48	1.50	1.12	1.25	1.17	.98	.61	.66	.61	.67	.....
5	1.40	1.86	1.46	1.14	1.29	1.14	.98	.61	.66	.61	.62	.....
6	1.30	3.42	1.38	1.25	1.42	1.10	.95	.61	.64	.59	.60	.....
7	1.24	3.31	1.32	1.29	1.47	1.08	.84	.62	.63	.59	.59	.....
8	1.16	3.51	1.27	1.43	1.55	1.04	.82	.64	.62	.59	.58	.....
9	1.12	4.21	1.24	1.65	1.55	1.03	.76	.64	.62	.58	.58	.....
10	1.08	3.30	1.20	2.11	1.52	1.09	.75	.64	.61	.58	.57	.....
11	1.06	2.85	1.23	2.00	1.66	1.06	.75	.62	.60	.57	.58	.....
12	1.07	2.51	1.23	1.84	1.58	1.07	.74	.61	.60	.57	.58	.....
13	1.01	2.25	1.18	1.78	1.57	1.05	.72	.61	.61	.59	.59	.....
14	1.00	2.20	1.20	1.67	1.45	1.01	.71	.61	.61	.59	.59	.....
15	.99	1.90	1.22	1.67	1.68	.98	.69	.61	.62	.58	.60	.....
16	.99	1.85	1.18	1.65	1.76	.93	.68	.61	.66	.57	.61	.....
17	.97	1.68	1.15	1.59	1.74	.92	.67	.61	.74	.58	.70	.....
18	.97	1.66	1.14	1.55	1.70	.92	.67	.60	.72	.61	.71	.....
19	.98	1.62	1.12	1.51	1.72	.91	.67	.59	.69	.60	.69	.....
20	1.05	1.70	1.10	1.45	1.64	.92	.64	.58	.68	.59	.69	.....
21	1.44	1.69	1.07	1.35	1.50	.92	.59	.58	.66	.58	.71	.....
22	1.78	1.66	1.06	1.42	1.46	.93	.66	.57	.66	.57	1.74	.....
23	1.76	1.64	1.04	1.47	1.40	.86	.64	.62	.65	.56	1.82	.....
24	1.68	1.73	1.00	1.53	1.34	.85	.62	.66	.64	.56	2.02	.....
25	1.57	1.99	.98	1.50	1.38	.85	.64	.74	.62	.56	2.21	.....
26	1.47	1.88	.99	1.44	1.36	.84	.64	.65	.61	.56	2.42	.....
27	1.38	1.80	.98	1.39	1.36	.84	.63	.63	.60	.59	2.13	.....
28	1.33	1.82	.96	1.34	1.37	.85	.63	.62	.63	.59	1.94	.....
29	1.28	.....	.98	1.32	1.39	.86	.63	.68	.62	.58	2.83	.....
30	1.25	.....	1.04	1.28	1.40	.79	.62	.68	.61	.58	3.12	.....
31	1.47	.....	1.00	.....	1.40	.....	.62	.69	.....	.59	.....	.....
1908.												
1	1.32	.88	1.34	1.54	1.62	1.76	1.57	.70	.72	.67	1.17	1.09
2	1.32	.84	1.23	1.46	1.69	1.74	1.64	.70	.71	.66	1.16	1.05
3	1.28	.84	1.20	1.42	1.79	1.74	1.60	.71	.69	.66	1.10	1.01
4	1.18	.83	1.16	1.41	1.73	1.73	1.58	.71	.68	.65	1.05	.96
5	1.32	1.00	1.11	1.42	1.60	1.72	1.50	.70	.68	.65	.97	.95
6	1.34	1.07	1.03	1.38	1.65	1.70	1.45	.69	.68	.67	.91	.94
7	1.36	1.04	1.00	1.36	1.65	1.75	1.36	.69	.69	.67	.86	.93
8	1.42	1.00	.98	1.34	1.65	1.79	1.34	.69	.68	.66	.84	.92
9	1.54	.99	.97	1.25	1.66	1.83	1.28	.71	.69	.66	.76	.91
10	1.65	.98	1.02	1.21	1.69	1.95	1.20	.72	.71	.65	.74	.90
11	1.66	.93	1.07	1.18	1.66	2.00	1.19	.71	.70	.64	.70	.89
12	1.68	.99	1.11	1.17	1.63	2.02	1.18	.71	.69	.65	.75	1.06
13	1.54	1.01	1.15	1.22	1.61	1.94	1.17	.70	.65	.67	.77	1.15
14	1.41	1.02	3.44	1.28	1.60	1.84	1.13	.70	.63	.71	.75	1.29
15	1.31	1.03	3.56	1.34	1.59	1.80	1.12	.69	.68	.72	.71	1.27
16	1.27	1.10	4.61	1.53	1.69	1.77	1.15	.69	.67	.75	.70	1.12
17	1.25	1.37	3.56	1.69	1.70	1.69	1.15	.70	.66	.78	.82	1.09
18	1.26	1.38	3.74	2.26	1.71	1.68	1.04	.70	.65	.79	1.54	1.05
19	1.22	1.31	2.16	2.58	1.72	1.70	.99	.68	.64	.73	1.56	1.04
20	1.27	1.25	1.91	2.45	1.75	1.71	.87	.68	.64	.61	1.45	1.00
21	1.25	1.18	1.80	2.40	1.78	1.74	.83	.67	.63	.78	1.42	.99
22	1.23	1.13	1.86	2.21	1.83	1.66	.81	.67	.63	.77	1.41	.99
23	1.21	1.06	1.88	2.04	1.81	1.61	.79	.66	.64	.75	1.40	1.05
24	1.17	1.21	1.93	2.02	1.81	1.52	.77	.65	.63	.74	1.39	1.12
25	1.15	1.28	1.95	1.90	1.80	1.51	.74	.65	.63	.71	1.38	1.64
26	1.12	1.34	1.90	1.78	1.78	1.51	.73	.64	.63	.70	1.38	1.85
27	1.04	1.47	1.83	1.72	1.76	1.50	.72	.64	.64	.69	1.30	1.94
28	1.01	1.42	1.73	1.67	1.74	1.49	.72	.73	.65	.68	1.21	2.15
29	.95	1.37	1.62	1.61	1.79	1.49	.72	.85	.67	.75	1.07	1.98
30	.94	.....	1.60	1.56	1.81	1.52	.71	.76	.69	.79	1.19	1.78
31	.91	.....	1.62	.....	1.80	.....	.71	.72	.....	1.06	.....	1.61

NOTE.—The gage heights were read with a hook gage and give the height above the crest of the dam.

Rating table for Cedar River near Ravensdale, Wash., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	190	1.50	860	2.50	1,805	3.50	2,965
.60	245	1.60	945	2.60	1,910	3.60	3,095
.70	300	1.70	1,035	2.70	2,020	3.70	3,230
.80	360	1.80	1,125	2.80	2,135	3.80	3,365
.90	420	1.90	1,215	2.90	2,250	3.90	3,500
1.00	485	2.00	1,310	3.00	2,365	4.00	3,635
1.10	555	2.10	1,405	3.10	2,480	4.20	3,915
1.20	625	2.20	1,505	3.20	2,600	4.40	4,205
1.30	700	2.30	1,605	3.30	2,720	4.60	4,500
1.40	780	2.40	1,705	3.40	2,840	4.80	4,800

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on the weir formula, using a coefficient of 3.75 as determined by discharge measurements made during 1902–1906, and is well defined.

Monthly discharge of Cedar River near Ravensdale, Wash., for 1907 and 1908.

[Drainage area, 170 square miles.]

Month.	Dischage in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	1,110	466	686	4.04	4.66	42,200	A.
February	3,930	844	1,520	8.94	9.31	84,400	A.
March	1,110	459	635	3.74	4.31	39,000	A.
April	1,420	555	845	4.97	5.54	50,300	A.
May	1,090	625	841	4.95	5.71	51,700	A.
June	788	354	490	2.88	3.21	29,200	A.
July	472	240	322	1.89	2.18	19,800	A.
August	324	228	259	1.52	1.75	15,900	A.
September	324	245	271	1.59	1.77	16,100	A.
October	256	223	237	1.39	1.60	14,600	A.
November	2,500	228	656	3.86	4.31	39,000	A.
The period						402,000	
1908.							
January	1,020	426	690	4.06	4.68	42,400	A.
February	836	378	570	3.35	3.61	32,800	A.
March	4,520	466	1,220	7.18	8.28	75,000	A.
April	1,890	604	1,010	5.94	6.63	60,100	A.
May	1,150	936	1,050	6.18	7.12	64,600	A.
June	1,330	852	1,050	6.18	6.90	62,500	A.
July	981	306	562	3.31	3.82	34,600	A.
August	390	267	299	1.76	2.03	18,400	A.
September	312	262	281	1.65	1.84	16,700	A.
October	527	250	309	1.82	2.10	19,000	A.
November	911	300	555	3.26	3.64	33,000	A.
December	1,460	414	644	3.79	4.37	39,600	A.
The year	4,520	250	687	4.04	55.02	499,000	

SUMMARY OF MEAN DISCHARGE PER SQUARE MILE.

The following summary of mean discharge per square mile is given to allow ready comparison of relative rates of run-off from different areas in the north Pacific coast drainages. It shows in a general way the seasonal distribution of run-off, and the effect of snow, ground, surface, and artificial storage. The most important fact worth noting is the almost entire lack of uniformity or agreement between any two stations. This indicates that the discharge of each stream is a law unto itself, and that all projects dependent on stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible.

Summary of mean discharge, in second-feet per square mile, in north Pacific coast drainage for 1907 and 1908.

Gaging station.	Drainage area (square miles).	1907. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	1908. Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Rogue River near Tolo, Oreg.	2,020	2.33	6.19	3.79	3.86	1.80	1.64	1.13	0.86	0.74	0.65	0.70	2.75	2.20	2.65	1.71	1.69	2.24	2.05	1.63	1.12	0.75	0.72	0.91	1.21	0.97	1.47
Little Butte Creek near Eagle Point, Oreg.	309	.....	.....	.....	.....	.....	.....	.....	.24	.26	.34	.38	2.00	.....	1.33	.65	.83	1.35	1.37	.48	.16	.11	.17	.62	.89	1.00	.75
Bear Creek at Talent, Oreg.	226	.....	.....	.....	.....	.....	.....	.....	.10	.14	.11	.18	.40	.....	.80	.53	.58	.56	.48	.29	.11	.02	.03	.12	.18	.14	.....
Applegate Creek at Murphy, Oreg.	620	.....	.....	.....	.....	.....	.....	.....	.25	.17	.14	.35	2.32	.....	2.10	1.55	1.61	1.59	1.26	1.08	.42	.08	.10	.39	.78	.49	.95
South Fork of Umpqua River near Brockway, Oreg.	1,800	4.23	6.22	3.77	3.69	.62	.36	.17	.13	.11	.13	.39	5.46	2.11	3.61	2.43	1.94	1.13	.84	.54	.22	.11	.09	.34	.68	.97	1.08
North Fork of Umpqua River near Oakcreek, Oreg.	1,000	7.03	13.4	6.49	9.00	3.24	2.38	1.54	1.26	1.17	1.11	2.84	11.6	5.09	6.74	3.99	3.52	4.36	4.25	3.02	2.14	1.45	1.02	.....	.....	.....	.....
Siletz River at Siletz, Oreg.	220	15.9	21.6	7.64	12.8	2.31	1.74	.86	.66	1.45	3.03	17.0	30.3	9.61	14.8	10.2	20.4	10.4	6.68	2.64	1.38	.90	.83	5.14	9.95	9.68	7.75
Columbia River at The Dalles, Oreg.	237,000	.43	.65	.70	1.03	1.77	2.54	2.03	1.00	.67	.48	.37	.37	1.00	.31	.27	.48	.79	1.60	2.56	1.95	.87	.50	.38	.36	.32	.87
Clark Fork at Missoula, Mont.	5,960	.13	.28	.50	1.10	1.76	2.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clark Fork at Newport, Wash.	24,000	.53	.74	.72	1.20	2.41	4.01	3.16	1.87	.94	.47	.46	.47	1.42	.38	.31	.48	.93	2.47	5.04	2.58	.99	.52	.45	.49	.41	1.26
Bitterroot River near Grantsdale, Mont.	1,550	.35	.51	.45	1.30	3.62	4.68	2.61	.52	.38	.24	.23	.23	1.26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Spokane River at Spokane, Wash.	4,000	1.70	1.88	3.10	4.35	5.35	3.52	1.15	.60	.62	.62	.56	.53	2.00	.54	.56	2.22	3.80	4.80	3.05	.68	.54	.46	.48	.58	.60	1.53
Johnson Creek near Riverside, Wash.	66	.06	.08	.12	.10	.06	.04	.04	.03	.05	.06	.07	.11	.07	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Salmon Creek near Malott, Wash.	152	.06	.06	.07	.23	1.41	1.09	.28	.17	.11	.08	.08	.07	.31	.07	.06	.10	.24	.82	.86	.13	.15	.05	.06	.09	.05	.22
Methow River at Pateros, Wash.	1,710	.24	.26	.33	.94	3.97	3.72	1.62	.54	.36	.32	.28	.26	1.07	.24	.24	.26	.68	2.58	4.00	1.88	.46	.28	.23	.26	.24	.95
Chelan River at Chelan, Wash.	950	.84	.94	1.16	1.69	6.07	7.94	5.63	2.44	1.28	1.06	.66	.43	2.51	.57	.51	1.68	2.00	4.25	7.86	7.31	2.57	1.27	.77	.71	.81	2.53
Yakima River near Martin, Wash.	56	3.34	9.20	5.79	6.66	17.96	9.45	2.93	1.74	1.59	1.32	4.36	6.12	5.87	3.38	2.39	9.41	8.39	12.3	15.8	7.98	2.38	1.29	2.61	4.18	2.16	6.02
Yakima River at Clealum Wash.	500	1.94	4.00	2.38	5.48	13.7	6.68	2.24	.96	.86	.52	1.42	2.50	3.56	1.36	1.09	5.66	7.06	9.82	10.6	5.98	1.47	.79	.93	2.20	1.41	4.03
Yakima River at Umtanum, Wash.	1,540	1.03	2.27	1.78	2.89	5.47	2.29	.76	.38	.45	.36	.44	.96	1.58	.75	.57	2.23	3.08	3.72	3.51	1.99	.64	.50	.33	.56	.53	1.53
Yakima River near Yakima, Wash.	3,300	.74	2.04	1.53	2.55	4.27	2.32	.75	.28	.34	.27	.36	.66	1.34	.52	.41	1.69	2.15	2.95	3.15	1.97	.48	.36	.34	.64	.49	1.26
Yakima River at Kiona, Wash.	5,230	.59	1.49	1.19	1.72	2.62	1.52	.42	.07	.11	.08	.21	.50	.88	.42	.32	1.15	1.52	1.80	1.90	1.16	.13	.10	.12	.33	.32	.77
Kachess River near Easton, Wash.	63	2.89	5.40	2.87	6.11	14.9	7.44	1.89	.52	.71	.30	2.71	4.05	4.15	1.94	1.37	7.49	7.41	9.78	12.2	6.14	1.03	.56	.94	2.52	1.97	4.45
Clealum River near Roslyn, Wash.	205	2.06	3.59	2.33	5.76	15.8	8.88	3.63	1.71	1.42	.72	1.32	2.43	4.14	1.53	1.05	4.64	7.12	11.0	13.7	8.34	2.22	1.19	1.03	2.95	1.54	4.69

Naches River near Nile, Wash	636	.90	2.23	1.57	3.18	6.37	4.18	1.67	.66	.51	.35	.51	.93	1.92	.69	.53	1.75	3.70	4.48	5.85	4.04	.89	.46	.44	1.01	.65	2.04
Naches River near North Yakima, Wash	1,120	.85	2.25	1.50	3.12	5.45	3.21	.74	.20	.16	.09	.21	.75	1.54	.55	.47	1.88	3.65	4.08	4.44	2.88	.43	.20	.24	.68	.33	1.65
Tieton River, at headworks near Naches, Wash. (at power house)	247	....	....	....	....	....	....	2.64	1.48	1.17	.98	.90	1.35	....	1.05	.92	3.09	3.91	4.21	6.07	5.06	2.01	1.30	1.13	1.51	.91	2.60
Tieton River at headworks near Naches, Wash. (cable gage)	247	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.30	1.13	1.51	....	....
Tieton River near Naches, Wash	270	1.51	2.91	1.89	3.29	5.44	4.52	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Fork of Atanum Creek near Tampico, Wash	66	....	....	....	....	....	....	....	....	.41	.39	....	....	....	....	....	....	....	3.12	3.95	1.67	.51	.34	.37	....	....	....
Atanum Creek at Narrows near Tampico, Wash	116	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.90	.23	.21	.20	.29	.27	....
Atanum Creek near Yakima, Wash	212	....	....	....	....	....	....	....	....	.06	.06	.08	.14	....	.18	.18	.89	.64	.69	1.23	.12	....	....	....	....	....	....
South Fork of Atanum Creek near Tampico, Wash	28	....	....	....	....	....	....	....	....	....	....	....	....	....	.67	....	2.05	2.68	.91	.40	.32	.27	.29	.34	....	....	....
Snake River near Minidoka, Idaho	17,900	....	....	.34	.68	1.22	1.63	1.23	.42	.35	.40	.41	.41	....	.35	.34	.44	.45	.63	1.20	.56	.26	.31	.38	.38	.36	.47
South Fork of Snake River at Moran, Wyo	820	....	....	.90	1.23	3.23	7.90	6.78	2.74	.74	1.07	.97	.78	....	.82	.73	.76	1.07	2.90	5.49	2.89	3.78	1.35	.92	.79	.74	1.85
South Fork of Snake River near Lyon, Idaho	5,480	....	....	.61	1.55	3.56	4.93	4.38	....	....	.98	.70	.59	....	.55	.51	.53	1.14	1.66	3.43	2.86	1.49	.79	.66	.53	.44	1.22
North Fork of Snake River near Ora, Idaho	1,040	.95	.95	1.03	1.95	2.67	2.15	1.56	1.26	1.23	1.23	1.16	1.10	1.44	1.11	1.03	1.03	1.83	1.82	2.56	1.48	1.20	1.17	1.22	1.12	1.03	1.38
Fall River at Fremont, Idaho	390	....	....	1.05	2.04	4.49	5.54	4.87	1.96	1.63	1.68	1.46	1.08	....	1.02	.79	1.06	2.24	3.33	6.03	3.85	1.33	1.44	1.28	1.07	1.27	2.06
Teton River near St. Anthony, Idaho	960	....	....	.59	.88	1.68	2.15	1.95	.96	.73	.72	.66	.60	....	.52	.49	.61	.80	1.20	2.92	1.94	.82	.70	.68	.59	.56	.99
Blackfoot River near Presto, Idaho	1,020	.24	.30	.32	1.43	1.40	1.00	.38	.25	.26	.32	.36	.30	.55	.24	.20	.28	.57	.33	.48	.16	.13	.15	.23	.24	.21	.27
Owyhee River at Owyhee, Oreg	9,880	.04	.56	.59	.62	.21	.13	.05	.01	.01	.01	.03	.03	.19	.05	.04	.11	.06	.04	.17	.03	.00	.01	.01	.02	.03	.05
Boise River near Highland, Idaho	2,610	....	....	2.14	4.29	4.21	3.41	2.07	.63	.40	.36	.36	.40	....	.41	.41	.87	2.44	2.29	2.07	1.23	.40	.35	.42	.38	.36	.97
Payette River near Horseshoe Bend, Idaho	2,240	....	....	2.48	4.37	5.98	5.85	3.56	1.21	.63	.53	.50	.53	....	.51	.47	1.00	2.77	3.14	3.38	2.00	.64	.56	.68	.63	.49	1.36
Malheur River at Vale, Oreg	4,860	.06	.45	.40	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.04	.02	.01	.01	.02	.03	....	....
Bully Creek near Vale, Oreg	650	.09	.36	.47	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Powder River at Salisbury, Oreg	275	.10	.67	.88	1.88	1.92	.80	.36	.10	.06	.07	.09	.13	.59	.15	.22	.74	1.47	1.01	.89	.36	.04	.02	.13	.13	.10	.44
Grande Ronde at Hilgard, Oreg	660	.39	1.45	1.76	2.30	1.21	.56	.19	.06	.12	.06	.07	.16	.69	.19	.09	1.79	2.55	1.15	.62	.15	.04	.03	.05	.12	.04	.57
Grande Ronde at Elgin, Oreg	1,350	.46	2.49	1.70	3.16	2.17	.94	.24	.07	.10	.12	.15	.18	.98	.15	.17	1.33	1.89	1.03	.51	.13	.04	.05	.10	.10	.12	.47
Wallowa River near Joseph, Oreg	47	1.34	1.28	1.39	2.09	3.55	9.36	10.7	6.81	....	....	....	....	....	....	....	....	....	....	....	9.26	5.89	....	....	1.38	.97	....
Wallowa River near Wallowa, Oreg	510	.81	1.26	1.07	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wallowa River near Elgin, Oreg	870	....	....	1.38	2.03	2.91	3.56	1.98	.78	.46	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.54	....

Summary of mean discharge, in second-feet per square mile, in north Pacific coast drainage for 1907 and 1908—Continued.

Gaging station.	Drainage area (square miles).	1907.													1908.												
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Palouse River at Hooper, Wash	2,210	0.56	2.18	1.61	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.02	0.01	0.01	0.02	0.03	0.04	.....
Walla Walla River near Milton, Oreg	130	2.16	3.87	2.32	1.54	1.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
South Fork of Walla Walla River near Milton, Oreg	72	1.93	2.38	2.10	2.32	2.31	1.82	1.64	1.64	1.65	1.64	1.81	1.94	1.93	1.83	1.82	.....	.....	.....	.....	.....	.....	.....	.....	2.10	2.06	.....
Umatilla River at Gibbon, Oreg	352	.....	.....	.....	.....	.....	.....	.....	.....	.....	.19	.31	1.28	.....	.71	.90	4.16	3.97	1.61	0.61	.30	.18	.20	.31	.39	.44	1.15
Umatilla River at Yoakum, Oreg	1,200	.70	2.40	1.56	2.05	.66	.14	.06	.04	.08	.10	.12	.56	.71	.35	.50	1.88	1.54	.48	.15	.03	.02	.02	.07	.10	.11	.44
Umatilla River near Umatilla, Oreg	2,130	.36	1.46	.94	1.07	.30	.03	.00	.00	.01	.01	.03	.24	.37	.16	.20	.85	.65	.15	.02	.00	.00	.00	.01	.02	.31	.18
John Day River at McDonald, Oreg	7,800	.19	1.01	.82	1.10	.68	.34	.10	.04	.03	.04	.06	.10	.38	.12	.09	.37	.56	.36	.32	.08	.02	.02	.05	.06	.05	.18
Deschutes River at Allen's ranch near Lava, Oreg	880	.25	.90	.39	.65	.79	.63	.38	.26	.22	.18	.18	.33	.43	.34	.19	.31	.46	.47	.38	.29	.16	.16	.20	.20	.20	.28
Deschutes River at West's ranch near Lava, Oreg	1,240	1.12	1.85	1.41	1.75	2.02	1.90	1.63	1.50	1.43	1.31	1.27	1.43	1.55	1.37	1.16	1.29	1.52	1.64	1.61	1.52	1.35	1.31	1.34	1.27	1.15	1.38
Deschutes River near Biggs, Oreg	9,180	.74	1.54	1.06	1.32	.99	.80	.68	.62	.62	.62	.66	.96	.88	.82	.66	.95	.94	.81	.71	.65	.59	.59	.59	.65	.63	.72
East Fork of Deschutes River at Crescent, Oreg	196	.46	.93	.53	.94	1.00	.77	.39	.24	.21	.18	.18	.35	.52	.30	.36	.31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
West Fork of Deschutes River near Lava, Oreg	360	2.49	2.89	2.66	3.22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tumalo Creek near Laidlaw, Oreg	90	2.61	2.29	1.68	1.48	3.10	3.59	3.02	1.39	1.24	1.16	.83	.96	1.95	1.00	1.09	.98	1.41	1.73	3.17	2.93	1.00	.93	1.05	.67	.77	1.40
Squaw Creek, near Sisters, Oreg	90	.....	.....	.....	.....	.....	.....	2.19	1.33	.89	.87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hood River at Winans, Oreg	370	3.46	6.03	3.97	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Middle Fork of Willamette River at Jasper, Oreg	1,450	6.12	12.0	3.08	5.69	1.57	1.20	.66	.46	.40	.40	1.60	9.66	3.57	4.20	2.43	3.88	3.14	3.06	2.69	1.33	.82	.71	1.66	1.97	1.98	2.32
Willamette River at Albany, Oreg	4,860	5.72	9.75	3.83	5.56	1.90	1.48	.93	.69	.60	.59	1.62	8.29	3.41	4.53	2.78	3.64	2.74	2.61	2.00	1.18	.76	.65	1.10	1.79	2.02	2.15
Coast Fork of Willamette River near Goshen, Oreg	690	6.36	8.17	4.33	5.36	.62	.55	.24	.23	.20	.22	1.72	9.55	3.13	4.70	3.36	2.70	2.19	2.61	2.06	.62	.25	.16	.88	1.32	1.87	1.89
McKenzie River near Springfield, Oreg	960	6.72	12.8	6.31	8.77	5.64	4.31	2.82	2.35	2.06	2.00	4.09	10.2	5.67	6.47	4.80	6.54	6.18	5.74	4.65	2.98	2.35	2.08	2.97	3.58	3.69	4.34
North Fork of Santiam River at Detroit, Oreg	256	.....	.....	.....	.....	.....	3.12	2.28	1.91	1.80	1.71	.....	.....	.....	.....	.....	.....	.....	.....	4.10	2.83	1.99	1.70	2.15	.....	.....	.....
North Fork of Santiam River at Mehama, Oreg	740	6.08	14.7	4.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

South Fork of Santiam River at Waterloo, Oreg.	640	11.0	37.2	6.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
South Fork of Yamhill River at Sheridan, Oreg.	290	9.66	10.1	4.00	6.62	1.26	.60	.....	.....	.33	.15	4.93	15.7	.....	11.0	7.31	8.48	6.41	3.17	1.84	.46	.29	.27	1.79	6.07	6.03	4.43
Molalla River near Molalla, Oreg.	220	7.64	12.1	5.68	8.73	2.49	1.54	.57	.34	.50	.64	3.92	10.8	4.58	6.38	4.26	7.05	6.55	5.86	3.91	.96	.32	.39	1.73	3.61	3.58	3.71
Clackamas River near Barton, Oreg.	800	8.02	14.2	4.50	8.69	4.21	2.54	1.70	1.23	1.10	1.00	4.00	10.9	5.17	6.01	3.64	8.08	6.59	5.19	4.39	1.94	1.19	1.04	1.84	2.95	2.86	3.81
Cedar River near Ravensdale, Wash.	170	4.04	8.94	3.74	4.97	4.95	2.88	1.89	1.52	1.59	1.39	3.86	.....	.....	4.06	3.35	7.18	5.94	6.18	6.18	3.31	1.76	1.65	1.82	3.26	3.79	4.04

INDEX.

A. Page.

Accuracy, degree of 27–28
Acknowledgments to those aiding 31
Acre-foot, definition of 15
Agency Creek near—
  Jocko, Mont.:
    description 114
    discharge 114
Albany, Oreg.,
  Fisher Creek at:
    discharge 388
  Oak Creek at:
    discharge 388
  Slaughter House Creek at:
    discharge 388
  Willamette River at:
    description 352
    discharge 352
    discharge, monthly 354–358, 396
    gage heights 353
    rating table 354
Allen, L. R., work of 31
American River near—
  Nile, Wash.:
    discharge 206
Antelope Creek near—
  Eagle Point, Oreg.:
    discharge 46
Applegate Creek at—
  Murphy, Oreg.:
    description 43
    discharge 44
    discharge, daily 45, 394
    discharge, monthly 46
    gage heights 44
Appropriations, amount of 9, 30
Ash, Oreg.,
  Mill Creek near:
    description 56–57
    discharge 57
    gage heights 57–58
Ashland, Oreg.,
  Ashland Creek at:
    discharge 46
  Bear Creek at:
    discharge 46
  Emigrant Creek at:
    discharge 46
  Neil Creek at:
    discharge 46
Asotin Creek near—
  Asotin, Oreg.:
    discharge 284
Atanum Creek at and near— Page.
  Narrows, Wash.:
    description 186
    discharge 186
    discharge, monthly 187, 395
    gage heights 186
    rating table 186
  Tampico, Wash.:
    discharge 206
  Yakima, Wash.:
    description 187
    discharge 187
    discharge, monthly 189, 395
    gage heights 188
    rating table 188
Atanum Creek (North Fork) near—
  Tampico, Wash.:
    description 184
    discharge 184
    discharge, monthly 185, 395
    gage heights 184–185
    rating table 185
Atanum Creek (South Fork) near—
  Tampico, Wash.:
    description 189
    discharge 190
    discharge, monthly 191, 395
    gage heights 190
    rating table 190
Austin, Oreg.,
  John Day River (Middle Fork) at:
    discharge 304
Authority for investigations, recital of 9

B.

Barnhart, Oreg.,
  ditches near:
    discharge 299
Barton, Oreg.,
  Clackamas River near:
    description 385
    discharge 385
    discharge, monthly 387, 397
    gage heights 386
    rating table 387
Bear Creek at—
  Ashland, Oreg.:
    discharge 46
  Talent, Oreg.:
    description 40–41
    discharge 41
    discharge, monthly 42, 394
    gage heights 41–42
    rating tables 42

Page.
Beaver Creek at—
Paulina, Oreg.:
discharge 339
Bend, Oreg.,
Central Oregon canal near:
description 330
discharge 330
discharge, monthly 332
gage heights 330–331
rating table 332
Deschutes River at:
description 312
discharge 312
gage heights 312–313
Pilot Butte canal near:
description 330
discharge 332
discharge, monthly 334
gage heights 333
rating table 334
Tumalo Creek near:
description 319–320
discharge 321
discharge, monthly 323–324
gage heights 322
rating tables 322–323
Beulah, Oreg.,
Malheur River (North Fork) at:
discharge 284
Big Bend canal at—
Joseph, Oreg.:
discharge 284
Big Butte Creek at or near—
Butte Falls, Oreg.:
discharge 46
Derby, Oreg.:
discharge 46
Big Creek near—
Knappa, Oreg.:
discharge 81
Biggs, Oreg.,
Deschutes River near:
description 313
discharge 314
discharge, monthly 315, 396
gage heights 314–315
rating table 315
Big Knife Creek near—
Jocko, Mont.:
description 114
discharge 114
Big Lost River near—
Chilly, Idaho:
description 235
discharge 236
gage heights 236
Big Wood River near—
Shoshone, Idaho:
description 237
discharge 237
discharge, monthly 238
gage heights 237–238
rating table 238
Bitterroot River near—
Grantsdale, Mont.:
description 90
discharge 90
discharge, monthly 92, 394
Bitterroot River near—Continued. Page.
Grantsdale, Mont.—Continued.
gage heights 91
rating table 91
Blackfoot, Idaho,
Snake River near:
description 211
discharge 211
Blackfoot River basin, description of 231
stream flow in 231–241
Blackfoot River near—
Presto, Idaho:
description 231–232
discharge 232
discharge, monthly 234–235, 395
gage heights 232–233
rating tables 233–234
Rossfork, Idaho:
description 231
discharge 231
gage heights 231
Blockhouse, Wash.,
Bowman Creek at:
discharge 80
Little Klickitat River at:
discharge 80
Mill Creek at:
discharge 80
Spring Creek at:
discharge 80
Boise River basin, description of 245
seepage studies on 248–252
stream flow in 245, 248
Boise River near—
Caldwell, Idaho:
discharge 284
Highland, Idaho:
description 245
discharge 245
discharge, monthly 248, 395
gage heights 246
rating tables 247
Boulder Creek (Clealum River) at—
Galena, Wash.:
discharge 206
Boulder Creek (Santiam River) at—
Detroit, Oreg.:
discharge 388
Bowman Creek at—
Blockhouse, Wash.:
discharge 80
Breitenbush Creek at—
Detroit, Oreg.:
discharge 388
Brockway, Oreg.,
Umpqua River (South Fork) near:
description 48
discharge 48
discharge, monthly 50, 394
gage heights 49
rating table 50
Bull Run River near—
Bull Run, Oreg.:
description 343
discharge 344
discharge, monthly 345
gage heights 344
rating tables 345

Page.
Bully Creek near—
Vale, Oreg.:
description 260
discharge 284
discharge, monthly 261, 395
gage heights 261
rating table 261
Bumping Lake, Wash.,
Bumping River near:
discharge 206
Bumping River near—
Bumping Lake, Wash.:
discharge 206
Burnt River at—
Durkee, Oreg.:
discharge 284
Butte Falls, Oreg.,
Big Butte Creek at:
discharge 46

C.

Cabin Creek near—
Easton, Wash.:
discharge 206
Caldwell, Idaho,
Boise River near:
discharge 284
Callapooya River near—
Tangent, Oreg.:
discharge 384
Camp Creek at—
Galena, Wash.:
discharge 206
Canyon City, Oreg.,
Canyon Creek at
discharge 304
Canyon Creek (John Day River) at or near—
Canyon City, Oreg.:
discharge 304
John Day, Oreg.:
discharge 304
Canyon Creek (Lewis River) at—
mouth:
discharge 80
Carson, Wash.,
Wind River at:
discharge 80
Cascade Locks, Oreg.,
Columbia River at:
gage heights 71
rating table 72
Cashmere, Wash.,
Mission Creek at:
discharge 133
Wenatchee River at:
description 130–131
discharge 131
gage heights 132
Catherine Creek near—
Union Oreg.:
description 275
discharge 275
Cazadero, Oreg.,
canals at:
discharge 388
Clackamas River at:
discharge 388

Page.
Cedar River near—
Ravensdale, Wash.:
description 390
discharge, monthly 392, 397
gage heights 391
rating table 392
Central Oregon canal near—
Bend, Oreg.:
description 330
discharge 330
discharge, monthly 332
gage heights 330–331
rating table 332
Chandler, Wash.,
Yakima River at:
discharge 206
Chelan River at—
Chelan, Wash.:
description 128
discharge 128
discharge, monthly 130, 394
gage heights 129
rating table 130
Chilly, Idaho,
Big Lost River near:
description 235
discharge 236
gage heights 236
Chilwist Creek at—
Malott, Wash.:
discharge 125
Clackamas River at or near—
Barton, Oreg.:
description 385
discharge 385
discharge, monthly 387, 397
gage heights 386
rating tables 387
Cazadero, Oreg.:
discharge 388
Estacada, Oreg.:
description 383
discharge 383
discharge, monthly 385
gage heights 384
rating table 384
Gladstone, Oreg.:
discharge 388
Clark Fork at—
Missoula, Mont.:
description 83
discharge 84
discharge, monthly 85, 394
gage heights 84
rating table 84
Newport, Wash.:
description 85
discharge, monthly 88–89, 390
gage heights 86–87
rating table 88
Priest River, Idaho:
description 85
discharge 85–86
Clark Fork basin, description of 81–83
miscellaneous measurements in 117
stream flow in 83–117

Clealum, Wash.,
Roslyn Creek at: Page.
discharge 206
Yakima River at:
description 140
discharge 141
discharge, monthly 142–143, 394
gage heights 141–142
rating table 142
Clealum Lake near—
Roslyn, Wash.:
description 161–162
gage heights 162–164
storage in 164
Clealum River near—
Roslyn, Wash.:
description 164–165
discharge 165
discharge, monthly 167, 394
gage heights 165–166
rating table 166
Clealum River (North Fork) at—
Galena, Wash.:
description 160
discharge 161
gage heights 161
Columbia River at and near—
Cascade Locks, Oreg.:
gage heights 71
rating table 72
Pasco, Wash.:
description 66
gage heights 66–67
The Dalles, Oreg.:
description 67–69
discharge 69, 85
discharge, monthly 72–79, 394
discharge, yearly 79–80
discharge curve, plate showing 68
gage heights 70–71
rating table 71
Columbia River basin, description of 61–66
miscellaneous measurements in 80–81
stream flow in 66–388
Columbia southern canal near—
Laidlaw, Oreg.:
description 336
discharge 337, 338
discharge, monthly 338
gage heights 337
rating table 337
Sisters Bridge, Oreg.:
discharge 338–339
Congdon canal at—
North Yakima, Wash.:
discharge 207
Cooperation, credit for 29–30
Corvallis, Oreg.,
Oak Creek at—
discharge 388
Cow Creek at—
Hooper, Wash.:
discharge 284
Cowiche Creek near—
Cowiche, Wash.:
discharge 206
Crane Prairie, Oreg.,
Deschutes River (West Fork) at— Page.
discharge 338
Crescent, Oreg.,
Deschutes River (East Fork) at—
description 316
discharge 316
discharge, monthly 317, 396
gage heights 316–317
rating table 317
Crescent Creek at—
Crescent Lake, Oreg.:
discharge 338
Cressups Ferry, Wash.,
Lewis River (North Fork) at—
discharge 80
Crooked River near—
forks, Oreg.:
discharge 339
Post, Oreg.:
description 327
discharge 327
gage heights 327
Prineville, Oreg.:
description 328
discharge 328, 339
gage heights 328
Crow Creek near—
Ronan, Mont.:
description 97–98
discharge 98
discharge, monthly 100
gage heights 98–99
rating table 99
Current meter, description of 21–22
use of 20, 22–23
views of 22
Current-meter stations, views of 20

D.

Dairy Creek at—
Greeneville, Oreg.:
discharge 388
Dallas, Oreg.,
Dallas mill canal at—
discharge 388
Rickreal River at—
discharge 388
Dallas mill canal at—
Dallas, Oreg.:
discharge 388
Dayton, Mont.,
Little Bitterroot Creek near:
description 96
discharge, monthly 97
gage heights 96
rating table 97
Dayville, Oreg.,
John Day River near:
description 300
discharge 300
gage heights 300
John Day River (South Fork) at or near:
description 303
discharge 303, 304
gage heights 303

Page.
Definitions, statements of 15
Derby, Oreg.,
Big Butte Creek near:
discharge 46
Deschutes River at or near—
Bend, Oreg.:
description 312
discharge 312
gage heights 312-313
Biggs, Oreg.:
description 313
discharge 314
discharge, monthly 315,396
gage heights 314-315
rating table 315
dam:
discharge 338
East Fork, Oreg.:
discharge 338
Lava, Oreg.:
description 306,309
discharge 306,310
discharge, daily 308,396
discharge, monthly 309,311
gage heights 307,310-311
rating table 308,311
Metolius River, Oreg.:
discharge 338
Tetherow, Oreg.:
discharge 338
Deschutes River basin, canals in 330-338
description of 304-306
miscellaneous measurements in 338-339
stream flow in 306-329
Deschutes River (East Fork) at—
Crescent, Oreg.:
description 316
discharge 316
discharge, monthly 317,396
gage heights 316,317
rating table 317
Deschutes River (West Fork) at or near—
Crane Prairie, Oreg.:
discharge 338
Lava, Oreg.:
description 318
discharge 318
discharge, monthly 319,396
gage heights 318
rating table 318
Detroit, Oreg.,
Boulder Creek at:
discharge 388
Breitenbush Creek at:
discharge 388
Minto Creek at:
discharge 388
Permelia Creek near:
description 370
discharge 370
gage heights 371
Puzzle Creek near:
description 369-370
discharge 370
gage heights 370

Page.
Detroit, Oreg.—Continued.
Santiam River (Marion Fork) near:
description 368
discharge 369
gage heights 369
Santiam River (North Fork) at:
description 364
discharge 364,388
discharge, monthly 366,396
gage heights 364-365
rating table 365
Whitewater Creek near:
description 371
discharge 372
gage heights 372
Woodpecker Creek at:
discharge 388
Dillon, Oreg.,
Umatilla River near:
discharge 299
Discharge, computation of 23-27
curves for 23-24
summary of 394
Discharge measurements, nature of 17-18
Dixie Creek at—
Rye Valley, Oreg.:
discharge 284
Drainage, stream flow and 11-12
Drainage basins, list of 12
Drewsey, Oreg.,
Malheur River (Middle Fork) at:
discharge 284
Dry Creek near—
St. Ignatius, Mont.:
description 105
discharge 105
discharge, monthly 106
gage heights 106
rating table 106
Durkee, Oreg.,
Burnt River at:
discharge 284
Dutch Flat Creek at—
Haines, Oreg.:
discharge 265

E.

Eagle Creek (Clackamas River):
discharge 388
Eagle Creek (Powder River) at—
Newbridge, Oreg.:
discharge 265
Eagle Point, Oreg.,
Antelope Creek near:
discharge 46
Little Butte Creek near:
description 38
discharge 39
discharge, monthly 40,394
gage heights 39
rating table 40
East Finley Creek near—
Jacko, Mont.:
description 115
discharge 115
Easton, Wash.,
Cabin Creek near:
discharge 206

Easton, Wash.—Continued.
Kachess Lake near: Page.
description 156
gage heights 156–157
storage in 157
Kachess River near:
description 158
discharge 158
discharge, monthly 160, 394
gage heights 158–159
rating table 159
Mosquito Creek near:
discharge 206
Silver Creek near:
discharge 206
Yakima River at:
discharge 206
Echo, Oreg.,
ditches near:
discharge 299
Umatilla River near:
discharge 299
Electron, Wash., power plant near, views of. 388
Elgin, Oreg.,
Grande Ronde River at:
description 270–291
discharge 271
discharge, monthly 273, 395
gage heights 271–272
rating table 272
Wallowa River near:
description 278–279
discharge 279
discharge, monthly 280, 395
gage heights 279
rating table 280
Elkton, Oreg.,
Umpqua River near:
description 50–51
discharge 51
discharge monthly 53
gage heights 51–52
rating table 52
Ellsworth, C. E., work of 31
Equivalents, table of 16–17
Erwin, Oreg.,
Powder River at:
discharge 265
Estacada, Oreg.,
Clackamas River at:
description 383
discharge 383
discharge, monthly 385
gage heights 384
rating table 384

F.

Fall River at—
Fremont, Idaho:
description 226
discharge 226
discharge, monthly 228, 395
gage heights 226–227
rating table 227
Finley Creek near—
Jacko, Mont.:
description 115
discharge 115
Fisher Creek at—
Albany, Oreg.: Page.
discharge 388
Fivepoint Creek at—
Hilgard, Oreg.:
discharge 284
Flathead River near—
Polson, Mont:
description 92–93
discharge 93
discharge, monthly 95
gage heights 93–94
rating table 94
Float method, description of 21
Flood prevention, stream flow and 12
Forest Grove, Oreg.,
Gales Creek at:
discharge 388
Tualitin River at:
discharge 388
Fortune Creek at—
Galena, Wash.:
discharge 206
Fremont, Idaho,
Fall River at:
description 226
discharge 226
discharge, monthly 228, 395
gage heights 226–227
rating table 227
Furnas ranch, views of 290

G.

Gage heights, nature of 17
Gaging station, description of 20
classification of 24–27
Galena, Wash.,
Boulder Creek at:
discharge 206
Camp Creek at:
discharge 206
Clealum River (North Fork) at:
description 160
discharge 161
gage heights 161
Fortune Creek at:
discharge 206
Paris Creek at:
discharge 206
Gales Creek at—
Forest Grove, Oreg.:
discharge 388
Gibbon, Oreg.,
Umatilla River at:
description 291
discharge 292, 299
discharge, monthly 293, 396
gage heights 292
rating table 293
Gist, Oreg.,
Three Creeks at:
discharge 339
Glaciers, views of 168
Gladstone, Oreg.,
Clackamas River at:
discharge 388

Goldendale, Wash.,
Little Klickitat River at: Page.
discharge 80
Gold Ray, Oreg.,
power canal at:
discharge 46
Goodrich Creek at—
Wingville, Oreg.:
discharge 265
Goshen, Oreg.,
Willamette River (Coast Fork) near:
description 358
discharge 358
discharge, monthly 360, 396
gage heights 359
rating table 360
Grande Ronde River at—
Elgin, Oreg.:
description 270–271
discharge 271
discharge, monthly 273, 395
gage heights 271–272
rating table 272
Hilgard, Oreg.:
description 267
discharge 267
discharge, monthly 270, 395
gage heights 267–269
rating tables 269
La Grande, Oreg.:
discharge 284
Zindel, Wash.:
description 273
gage heights 274
Grande Ronde River basin, description of 265–266
stream flow in 267–280
Granger Canal at—
Joseph, Oreg.:
discharge 284
Granite, Oreg.,
Granite Creek at:
discharge 304
Grantsdale, Mont.,
Bitterroot River near:
description 90
discharge 90
discharge, monthly 92, 394
gage heights 91
rating table 91
Greeneville, Oreg.,
Dairy Creek at:
discharge 388

H.

Haines, Oreg.,
Dutch Flat Creek at:
discharge 265
Powder River at:
discharge 265
Henshaw, F. F., work of 31
Highland, Idaho,
Boise River near:
description 245
discharge 245
discharge, monthly 248, 395
gage heights 246
rating table 247
Hilgard, Oreg.,
Fivepoint Creek at: Page.
discharge 284
Grande Ronde River at:
description 267
discharge 267
discharge, monthly 270, 395
gage heights 267–269
rating table 269
Homedale, Idaho,
Succor Creek near:
description 239
discharge 239
discharge, monthly 241
gage heights 239–240
rating table 240–241
Hood River at—
Winans, Oreg.:
description 339–340
discharge, monthly 340, 396
gage heights 340
rating table 340
Hood River basin, description of 339
Hooper, Wash.,
Cow Creek at:
discharge 284
Palouse River at:
description 281
discharge 282
discharge, monthly 283, 396
gage heights 282
rating table 283
Horseshoe Bend, Idaho,
Payette River near:
description 253–254
discharge 254
discharge, monthly 256, 395
gage heights 254–255
rating table 255
Huch, A. F., work of 31

I.

Ice, measurements under 23, 27
Indian Creek:
discharge 304
Indian ditch near—
Jocko, Mont.:
description 116
discharge 116
Investigations, authority for 10
purposes of 11
scope of 10–11
Irrigation, stream flow and 11

J.

Jackson Lake near—
Moran, Wyo.:
description 218
gage heights 218
Jasper, Oreg.,
Willamette River (Middle Fork) at:
description 349
discharge 349
discharge, monthly 351, 396
gage heights 349–350
rating table 350–351

Page.
Jefferson, Oreg.,
Santiam River at:
description 367-368
discharge 368
gage heights 369
Jocko, Mont.,
Agency Creek near:
description 114
discharge 114
Big Knife Creek near:
description 114
discharge 114
East Finley Creek near:
description 115
discharge 115
Finley Creek near:
description 115
discharge 115
Indian ditch near:
description 116
discharge 116
Jocko River at or near—
Jocko, Mont.:
description 110
discharge 110
gage heights 111
Ravalli, Mont.:
description 111
discharge 111
discharge, monthly 113
gage heights 112
rating table 113
John Day, Oreg.,
Canyon Creek near:
discharge 304
John Day River at or near—
Dayville, Oreg.:
description 300
discharge 300, 304
gage heights 300
John Day, Oreg.:
discharge 304
McDonald, Oreg.:
description 301
discharge 301
discharge, monthly 303, 396
gage heights 301-302
rating table 302
Margaret Springs, Oreg.:
discharge 304
Prairie City, Oreg.:
discharge 304
Spray, Oreg.:
discharge 304
John Day River (Middle Fork) at—
Austin, Oreg.:
discharge 304
Ritter, Oreg.:
discharge 304
John Day River (North Fork) at—
Monument, Oreg.:
discharge 304
John Day River (South Fork) at or near—
Dayville, Oreg.:
description 303
discharge 303, 304
gage heights 303

Page.
John Day River basin, description of 299-300
miscellaneous discharges in 304
stream flow in 300-304
Johnson Creek near—
Riverside, Wash.:
description 121
discharge, daily 121
discharge, monthly 121, 394
Joseph, Oreg.,
canals at:
discharge 284
Wallowa River near:
description 275
discharge 275
discharge, monthly 277, 395
gage heights 276
rating table 277

K.

Kachess Lake, Wash.,
evaporation station at:
description 207
evaporation 208
precipitation 208
Kachess Lake near—
Easton, Wash.:
description 156
gage heights 156-157
storage in 157
Kachess River near—
Easton, Wash.:
description 158
discharge 158
discharge, monthly 160, 394
gage heights 158-159
rating table 159
Kalispell, Mont.,
Stillwater River near:
description 95
gage heights 95
Keechelus Lake near—
Martin, Wash.:
description 135-136
gage heights 136
storage in 137
Kennewick, Wash., irrigated lands near, view of 36
Kid Valley, Wash.,
Toutle River at:
discharge 81
Kimble, Howard, work of 31
Kiona, Wash.,
Kiona canal near:
description 205
discharge 205
gage heights 205
Yakima River at or near:
description 152
discharge 153, 206
discharge, monthly 154-155, 394
gage heights 153-154
rating table 154
Kiona canal near—
Kiona, Wash.:
description 205
discharge 205
gage heights 205

Klickitat River at—
Wright, Wash.: Page.
discharge 80
Knappa, Oreg.,
Big Creek near:
discharge 81

L.

La Fayette, Oreg.,
Yamhill River at:
description 379–380
gage heights 380
Yamhill River (North Fork) at:
discharge 388
La Grande, Oreg.,
Grande Ronde River at:
discharge 284
Laidlaw, Oreg.,
Columbia Southern Canal near:
description 336
discharge 337,338
discharge, monthly 338
gage heights 337
rating table 337
Lewis Creek near:
description 324
discharge 324
gage heights 325
Tumalo Creek near:
description 319–320
discharge 320
discharge, monthly 321,396
gage heights 320
rating table 321
Wimer canal near:
description 334–335
discharge 335
discharge, monthly 336
gage heights 335
rating table 336
Lardo, Idaho,
Payette River (North Fork) at:
description 253
discharge 253
gage heights 253
La Rue, E. C., work of 31
Lava, Oreg.,
Deschutes River near:
description 306,309
discharge 306,310
discharge, daily 308,396
discharge, monthly 309,311
gage heights 307,310–311
rating tables 308,311
Deschutes River (West Fork) near:
description 318
discharge 318
discharge, monthly 319,396
gage heights 318
rating table 318
Spring Creek near:
discharge 338
Lewis, J. H., aid of 31
Lewis Creek near—
Laidlaw, Oreg.:
description 324
discharge 324
gage heights 325
Lewis River (North Fork) at—
Cressups Ferry, Wash.: Page.
discharge 80
Little Bitterroot Creek near—
Dayton, Mont.:
description 96
discharge, monthly 97
gage heights 96
rating table 97
Little Butte Creek near—
Eagle Point, Oreg.:
description 38
discharge 39
discharge, monthly 40,394
gage heights 39
rating table 40
Little Klickitat River at—
Blockhouse, Wash.:
discharge 80
Goldendale, Wash.:
discharge 80
Long Tom River near—
Monroe, Oreg.:
discharge 388
Los Angeles, Cal., gaging station at, view of 20
Loup Loup Creek at—
Malott, Wash.:
discharge 125
Lovely, Oreg.,
Minam River at:
discharge 284
Wallowa River at:
discharge 284
Luckiamute River near—
Suver, Oreg.:
description 373–374
discharge 374
discharge, monthly 376
gage heights 374–375
rating table 375
Lyon, Idaho,
Snake River (South Fork) near:
description 220–221
discharge 221
discharge, monthly 223,395
gage heights 221–222
rating table 222

M.

McAllister canal at—
Sisters, Oreg.:
discharge 339
McDonald, Oreg.,
John Day River at:
description 301
discharge 301
discharge, monthly 303,396
gage heights 301–302
rating table 302
McGlashan, H. D., work of 31
McKay Creek at—
Powell's ranch:
discharge 299
McKenzie River near—
Springfield, Oreg.:
description 361
discharge 361
discharge, monthly 363,396
gage heights 362
rating tables 363

Page.
Malheur River basin, description of..... 256–257
stream flow in..... 257–261
Malheur River near—
Vale, Oreg.:
description..... 257–258
discharge..... 258
discharge, monthly..... 259, 395
gage heights..... 258
rating tables..... 259
Malheur River (Middle Fork) at—
Drewsey, Oreg.:
discharge..... 284
Riverside, Oreg.:
description..... 259–260
gage heights..... 260
Warm Spring ranch, Oreg.:
discharge..... 284
Malheur River (North Fork) at—
Beulah, Oreg.:
discharge..... 284
Malott, Wash.,
Chilwist Creek at:
discharge..... 125
Loup Loup Creek at:
discharge..... 125
Salmon Creek near:
description..... 122
discharge..... 122
discharge, monthly..... 124, 394
gage heights..... 123
rating table..... 124
Marcola, Oreg.,
Mohawk River at:
discharge..... 388
Martin, Wash.,
Keechelus Lake near:
description..... 135–136
gage heights..... 136
storage in..... 137
Yakima River near:
description..... 137
discharge..... 137
discharge, monthly..... 139–140, 394
gage heights..... 138
rating table..... 139
Marys River near—
Philomath, Oreg.:
discharge..... 388
Meacham Creek near—
mouth:
discharge..... 299
Mehama, Oreg.,
Santiam River (North Fork) at:
description..... 366
discharge..... 366
discharge, monthly..... 367, 396
gage heights..... 366
rating table..... 367
Methow River at—
Pateros, Wash.:
description..... 125
discharge..... 125
discharge, monthly..... 127, 394
gage heights..... 126
rating table..... 127
Metolius River near—
head, Oreg.:
discharge..... 339

Page.
Metolius River near—Continued.
Jack Creek, Oreg.:
discharge..... 339
mouth, Oreg.:
discharge..... 339
Sisters, Oreg.:
description..... 329
discharge..... 329
gage heights..... 329
Miles, Oreg.,
ditches at and near:
discharge..... 265
Mill Creek (Little Klickitat River) at—
Blockhouse, Wash.:
discharge..... 80
Mill Creek (Rogue River) at—
Prospect, Oreg.:
discharge..... 46
Mill Creek (Umpqua River) near—
Ash, Oreg.:
description..... 56–57
discharge..... 57
gage heights..... 57–58
Milton, Oreg.,
Walla Walla River near:
description..... 285–286
discharge..... 286
discharge, monthly..... 287, 396
gage heights..... 286
rating table..... 287
Walla Walla River (South Fork) near:
description..... 287–288
discharge..... 288
discharge, monthly..... 290, 396
gage heights..... 288–289
rating table..... 289
Minam River at—
Lovely, Oreg.:
discharge..... 284
Minidoka, Idaho,
dam near, view of..... 290
Snake River near:
description..... 215
discharge..... 215
discharge, monthly..... 217, 395
gage heights..... 215–216
rating table..... 217
Minto Creek at—
Detroit, Oreg.:
discharge..... 388
Mission Creek (Wenatchee River) at—
Cashmere, Wash.:
discharge..... 133
Mission Creek (Flathead River) near—
St. Ignatius, Mont.:
description..... 101–102
discharge..... 102
discharge, monthly..... 104–105
gage heights..... 102–103
rating tables..... 103–104
Missoula, Mont.,
Clark Fork at:
description..... 83
discharge..... 84
discharge, monthly..... 85, 394
gage heights..... 84
rating table..... 84

Mitchell canal at—
Joseph, Oreg.: Page.
discharge 284
Mohawk River at—
Marcola, Oreg.:
discharge 388
Molalla River near—
Molalla, Oreg.:
description 380
discharge 380
discharge, monthly 382, 397
gage heights 381
rating tables 382
Monroe, Oreg.,
Long Tom River near:
discharge 388
Monument, Oreg.,
John Day River (North Fork) at:
discharge 304
Moran, Wyo.,
Jackson Lake near:
description 218
gage heights 218
Snake River (South Fork) at:
description 218
discharge 218
discharge, monthly 220, 395
gage heights 219
rating table 220
Mosquito Creek near—
Easton, Wash.:
discharge 206
Mud Creek near—
Ronan, Mont.:
description 100
discharge 100
discharge, monthly 101
gage heights 101
rating table 101
Muddy Creek (Willamette River):
discharge 388
Muddy Creek (Powder River) near—
Rock Creek, Oreg.:
discharge 265
Muddy River at—
Philomath, Oreg.:
discharge 388
Multnomah Creek at—
mouth:
discharge 80
Murphy, Oreg.,
Applegate Creek at:
description 43
discharge 44
discharge, daily 45, 394
discharge, monthly 46
gage heights 44

N.

Naches, Wash.,
Northwestern Light and Power canal at:
discharge 207
Oak Creek near—
discharge 206
power canal near:
discharge 183
gage heights 183
Naches, Wash.—Continued.
Tieton River near: Page.
description 175–176, 177, 180–181
discharge 176, 177, 181
discharge, monthly 176, 180, 183, 395
gage heights 176, 178–179, 181–182
rating table 176, 179, 182
Naches-Cowiche canal at—
North Yakima, Wash.:
discharge 207
Naches River near—
Nile, Wash.:
description 167–168
discharge 168
discharge, monthly 170–171, 395
gage heights 169
rating tables 170
North Yakima, Wash.:
description 171–172
discharge 172
discharge, monthly 175, 395
gage heights 172–173
rating tables 174
Narrows, Wash.,
Atanum Creek at:
description 186
discharge 186
discharge, monthly 187, 395
gage heights 186
rating table 186
Nasty Creek at—
Tampico, Wash.:
discharge 206
Navigation, stream flow and 11
Neeley, Idaho,
Snake River at:
description 212
discharge 212
discharge, monthly 214
gage heights 213
rating table 214
Neil Creek at—
Ashland, Oreg.:
discharge 46
Newbridge, Oreg.,
ditches at and near:
discharge 265
Newport, Wash.,
Clark Fork at:
description 85
discharge, monthly 88–89, 394
gage heights 86–87
rating table 88
New Reservation canal near—
Yakima, Wash.:
description 192–193
discharge 193
discharge, daily 196
discharge, monthly 196–197
gage heights 194–195
New Union canal at—
North Yakima, Wash.:
discharge 207
Nile, Wash.,
American River near:
discharge 206

Nile, Wash.—Continued.
Naches River near: Page.
description 167–168
discharge 168
discharge, monthly 170–171, 395
gage heights 169
rating table 170
Rattlesnake Creek near:
discharge 206
North Powder, Oreg.,
Powder River at:
discharge 265
Northwestern Light and Power canal at—
Naches, Wash.:
discharge 207
North Yakima, Wash.,
Congdon canal at:
discharge 207
Naches-Cowiche canal at:
discharge 207
Naches River near:
description 171–172
discharge 172
discharge, monthly 175, 395
gage heights 172–173
rating table 174
New Union canal at:
discharge 207
Old Union canal at:
discharge 207
Parker canal at:
discharge 207
Power canal at:
discharge 207
Town canal at:
discharge 207

O.

Oakcreek, Oreg.,
Umpqua River (North Fork) near:
description 53–54
discharge 54
discharge, monthly 394
gage heights 55
Oak Creek (Callapooya River) at—
Albany, Oreg.:
discharge 388
Corvallis, Oreg.:
discharge 388
Oak Creek (Tieton River) near—
Naches, Wash.:
discharge 206
Ochoco Creek near—
Prineville, Oreg.:
description 328
discharge 328, 339
gage heights 329
Odell Creek at—
Odell Lake:
discharge 338
Okanogan River at—
Riverside, Wash.:
discharge 125
Okanogan River basin, description of 120–121
miscellaneous measurements in 125
stream flow in 121–125
Old Reservation canal near—
Wapato, Wash.: Page.
description 197–198
discharge 198, 200
discharge, monthly 199, 200
gage heights 198–199, 200
rating table 199, 200
Old Union canal at—
North Yakima, Wash.:
discharge 207
Ora, Idaho,
Snake River (North Fork) near:
description 223
discharge 224
discharge, monthly 225, 395
gage heights 224–225
rating table 225
Oregon, cooperation of 29–30
Owyhee River at—
Owyhee, Oreg.:
description 242
discharge 242
discharge, monthly 244, 395
gage heights 243
rating table 244
Owyhee River basin, description of 241–242
stream flow in 242–244

P.

Padgett, H. D., work of 31
Palouse River at—
Hooper, Wash.:
description 281
discharge 282
discharge, monthly 283, 396
gage heights 282
rating table 283
Palouse River basin, description of 280–281
stream flow in 281–283
Paps Creek:
discharge 304
Paris Creek at—
Galena, Wash.:
discharge 206
Parker, G. L., work of 31
Parker canal at—
North Yakima, Wash.:
discharge 207
Pasco, Wash.,
Columbia River near:
description 66
gage heights 66–67
Pateros, Wash.,
Methow River at:
description 125
discharge 125
discharge, monthly 127, 394
gage heights 126
rating table 127
Pateros ditch at:
discharge 128
Paulina, Oreg.,
Beaver Creek at:
discharge 339
Payette River basin, description of 252–253
stream flow in 253–256

Payette River near—
Horseshoe Bend, Idaho: Page.
description 253–254
discharge 254
discharge, monthly 256, 395
gage heights 254–255
rating table 255
Payette River (North Fork) at—
Lardo, Idaho:
description 253
discharge 253
gage heights 253
Pendleton, Oreg.,
ditches near:
discharge 299
Umatilla River near:
discharge 299
Permelia Creek near—
Detroit, Oreg.:
description 370
discharge 371
gage heights 371
Philomath, Oreg.,
Marys River near:
discharge 388
Muddy River at:
discharge 388
Woods Creek at:
discharge 388
Pilot Butte canal near—
Bend, Oreg.:
description 330
discharge 332
discharge, monthly 334
gage heights 333
rating table 334
Polson, Mont.,
Flathead River near:
description 92–93
discharge 93
discharge, monthly 95
gage heights 93–94
rating table 94
Porter, E. A., work of 31
Portland, Oreg.,
Willamette River at:
discharge 388
Post, Oreg.,
Crooked River near:
description 327
discharge 327
gage heights 327
Post, R. B., work of 31
Post Creek at or near—
Ronan, Mont.:
discharge 117
St. Ignatius, Mont.:
description 107
discharge 107
discharge, monthly 109–110
gage heights 108
rating table 109
Powder River at or near—
Erwin, Oreg.:
discharge 265
Haines, Oreg.:
discharge 265
North Powder River, Oreg.:
discharge 265
Powder River at—
Salisbury, Oreg.: Page.
description 262
discharge 262
discharge, monthly 264–265, 395
gage heights 263
rating tables 264
Sumpter, Oreg.:
discharge 265
Powder River basin, description of 261–262
miscellaneous measurements 265
stream flow in 262–265
Powder River (North Fork) at—
North Powder, Oreg.:
discharge 265
Power canal near—
North Yakima, Wash.:
discharge 207
Presto, Idaho,
Blackfoot River near:
description 231–232
discharge 232
discharge, monthly 234–235, 395
gage heights 232–233
rating table 233–234
Priest River, Idaho,
Clark Fork at:
description 85
discharge 85–86
Prineville, Oreg.,
Crooked River near:
description 328
discharge 328, 339
gage heights 328
Elliot ditch near:
discharge 329
Ochoco Creek near:
description 328
discharge 328, 339
gage heights 329
Prospect, Oreg.,
Mill Creek at:
discharge 46
Rogue River (North Fork) at:
description 33–34
discharge 34
gage heights 34–35
Prosser, Wash.,
Selah Valley canal at:
discharge 207
Sunnyside canal at:
discharge 207
Yakima River near:
discharge 206
Publications, lists of 12–15
Puget Sound basin, description of 389–390
stream flow in 390–392
Puyallup River, power plant on, view of 388
Puzzle Creek near—
Detroit, Oreg.:
description 369–370
discharge 370
gage heights 370

R.

Rating curves, construction and use of 24
Rating tables, construction of 24
nature of 18

Rattlesnake Creek near—
Nile, Wash.: Page.
discharge 206
Ravalli, Mont.,
Jocko River at:
description 111
discharge 111
discharge, monthly 113
gage heights 112
rating table 113
Valley Creek near:
description 116
discharge 116
Ravensdale, Wash.,
Cedar River near:
description 390
discharge 392, 397
gage heights 391
rating table 392
Revision, need for 28–29
Rexburg, Oreg.,
Snake River (North Fork) at:
discharge 284
Rice, R. C., work of 31
Richards, Raymond, work of 31
Richland, Wash.,
Yakima River near:
description 155
discharge 155
gage heights 155–156
Rickreal River at—
Dallas, Oreg.:
discharge 388
Rickreal, Oreg.:
discharge 388
Ritter, Oreg.,
John Day River (Middle Fork) at:
discharge 304
Riverside, Oreg.,
Malheur River (Middle Fork) at:
description 259–260
gage heights 260
Riverside, Wash.,
Johnson Creek near:
description 121
discharge, daily 121
discharge, monthly 121, 394
Okanogan River at:
discharge 125
Road Gulch:
discharge 206
Rock Creek, Oreg.:
discharge 265
Rogue River basin, description of 31–33
miscellaneous measurements in 46
power plant on, view of 36
stream flow in 33–46
Rogue River near—
Tolo, Oreg.:
description 35
discharge 36
discharge, monthly 38, 394
gage heights 36–37
rating tables 37
Rogue River (North Fork) at—
Prospect, Oreg.:
description 33–34
discharge 34
gage heights 34–35
Ronan, Mont.,
Crow Creek near: Page.
description 97–98
discharge 98
discharge, monthly 100
gage heights 98–99
rating table 99
Mud Creek near:
description 100
discharge 100
discharge, monthly 101
gage heights 101
rating table 101
Post Creek (North Fork) at:
discharge 117
Spring Creek at:
discharge 117
Roslyn, Wash.,
Clealum Lake near:
description 161–162
gage heights 162–164
storage in 164
Clealum River near:
description 164–165
discharge 165
discharge, monthly 167, 394
gage heights 165–166
rating table 166
Roslyn Creek near—
Clealum, Wash.:
discharge 206
Rossfork, Idaho,
Blackfoot River near:
description 231
discharge 231
gage heights 231
Run-off, computation of 23–28
definition of 15
Rye Valley, Oreg.,
Dixie Creek at:
discharge 284

S.

St. Anthony, Idaho,
Teton River near:
description 228
discharge 229
discharge, monthly 230, 395
gage heights 229–230
rating table 230
St. Ignatius, Mont.,
Dry Creek near:
description 105
discharge 105
discharge, monthly 106
gage heights 106
rating table 106
Mission Creek near:
description 101–102
discharge 102
discharge, monthly 104–105
gage heights 102–103
rating table 103–104
Post Creek near:
description 107
discharge 107
discharge, monthly 109–110
gage heights 108
rating table 109

Salisbury, Oreg.,
Powder River at: Page.
description 262
discharge 262
discharge, monthly 264–265, 395
gage heights 263
rating table 264
Salmon, Oreg.,
Salmon Creek at:
discharge 346
Sandy River at:
description 342
discharge 342
discharge, monthly 343
gage heights 342
rating table 343
Salmon Creek (Okanogan River) near—
Malott, Wash.:
description 122
discharge 122
discharge, monthly 124, 391
gage heights 123
rating table 124
Sandy River at or near—
Salmon, Oreg.:
description 342
discharge 342
discharge, monthly 343
gage heights 342
rating table 343
Sandy Bridge, Oreg.:
discharge 346
Troutdale, Oreg.:
discharge 346
Sandy River basin, description of 341
miscellaneous measurements in 346
stream flow in 341–346
Santiam River at—
Jefferson, Oreg.:
description 367–368
discharge 368
gage heights 369
Santiam River (Marion Fork) near—
Detroit, Oreg.:
description 368
discharge 369
gage heights 369
Fish Lake trail, Oreg.:
discharge 388
Santiam River (North Fork) at—
Detroit, Oreg.:
description 364
discharge 364, 388
discharge, monthly 366, 396
gage heights 364–365
rating table 365
Gatch Falls, view 364
Mehama, Oreg.:
description 366
discharge 366
discharge, monthly 367, 396
gage heights 366
rating table 367
Twin Falls, view of 364
Santiam River (South Fork) at—
Waterloo, Oreg.:
description 372
discharge, monthly 373, 397
gage heights 373
rating table 373
Satus Creek near—
Toppenish, Wash.: Page.
description 192
discharge 192
Schulers Gulch:
discharge 206
Second-foot, definition of 15
Section, changes in, estimation for 25–27
Selah Creek at or near—
Selah, Wash.:
discharge 206
Selah Gap, Wash.,
Selah Moxee flume at:
discharge 207
Selah Moxee flume at—
Selah Gap, Wash.:
discharge 207
Selah Valley canal at—
Prosser, Wash.:
discharge 207
Sheridan, Oreg.,
Yamhill River (South Fork) at:
description 376
discharge 377
discharge, monthly 379, 397
gage heights 377–378
rating table 378
Shitike Creek at—
Warm Springs Agency, Oreg.:
discharge 339
Shoshone, Idaho,
Big Wood River near:
description 237
discharge 237
discharge, monthly 238
gage heights 237–238
rating table 238
Siletz River at—
Siletz, Oreg.:
description 58–59
discharge 59
discharge, monthly 61, 394
gage heights 59–60
rating table 60
Siletz River basin, description of 58
stream flow in 58–61
Silver Creek (Pudding River) near—
Silverton, Oreg.:
discharge 388
Silver Creek (Yakima River) near—
Easton, Wash.:
discharge 206
Silver Lake canal at—
Joseph, Oreg.:
discharge 284
Silverton, Oreg.,
Silver Creek near:
discharge 388
Sisters, Oreg.,
McAllister canal near:
discharge 339
Metolius River near:
description 329
discharge 329
gage heights 329
Squaw Creek near:
description 325
discharge 325, 339
discharge, monthly 327, 396
gage heights 326
rating table 327

Page.
Slaughterhouse Creek at—
Albany, Oreg.:
discharge 388
Slope method, description of 18
Snake River at or near—
Blackfoot, Idaho:
description 211
discharge 211
Minidoka, Idaho:
description 215
discharge 215
discharge, monthly 217, 395
gage heights 215–216
rating table 217
Neeley, Idaho:
description 212
discharge 212
discharge, monthly 214
gage heights 213
rating table 214
Snake River basin, description of 209–211
miscellaneous measurements in 284
stream flow in 211–284
Snake River (North Fork) at or near—
Ora, Idaho:
description 223
discharge 224
discharge, monthly 225–395
gage heights 224–225
rating table 225
Rexburg, Idaho:
discharge 284
Snake River (South Fork) at or near—
Lyon, Idaho:
description 220–221
discharge 221
discharge, monthly 223, 395
gage heights 221–222
rating table 222
Moran, Wyo.:
description 218
discharge 218
discharge, monthly 220, 395
gage heights 219
rating table 220
Spirit Lake, Wash.,
Toutle River at:
discharge 80
Spokane River at—
Spokane, Wash.:
description 117–118
discharge 118
discharge, monthly 120, 394
gage heights 118–119
rating table 120
Spokane River basin, description of 117
stream flow in 117–120
Spring Creek (Crow Creek) at—
Ronan, Mont.:
discharge 117
Spring Creek (Deschutes River) near—
Lava, Oreg.,
discharge 338
Spring Creek (Little Klickitat River) at—
Blockhouse, Wash.:
discharge 80

Page.
Spring Creek (Malheur River):
discharge 284
Springfield, Oreg.,
McKenzie River near:
description 361
discharge 361
discharge, monthly 363, 396
gage heights 362
rating table 363
Squaw Creek near—
Sisters, Oreg.:
description 325
discharge 325, 339
discharge, monthly 327, 396
gage heights 326
rating table 327
Stevens, G. C., work of 31
Stevens, J. C., work of 31
Stewart, J. E., work of 31
Stillwater River near—
Kalispel, Mont.:
description 95
gage heights 95
Strawberry Creek:
discharge 304
Stream flow, summary of 393–397
Stream measurements, accuracy of 27–28
data of, use of 28–29
methods of 18–23
Succor Creek near—
Homedale, Idaho:
description 239
discharge 239
discharge, monthly 241
gage heights 239–240
rating tables 240–241
Sumpter, Oreg.,
Powder River at:
discharge 265
Sunnyside canal at or near—
Preading, view of 202
Prosser, Wash.:
discharge 207
Wapato, Wash.:
description 201
discharge 201, 202
discharge, monthly 204
gage heights 202–203
losses from 202
rating table 204
Suver, Oreg.,
Luckiamute River near:
description 373–374
discharge 374
discharge, monthly 376
gage heights 374–375
rating table 375
Swail Canyon Creek at—
Wright, Wash.:
discharge 80
Swamps, drainage of, stream flow and 11–12
Swalley canal at—
Bend, Oreg.:
discharge 338

T.

Page.
Tables, explanation of 17–18
Talent, Oreg.,
Bear Creek at:
description 40–41
discharge 41
discharge, monthly 42, 394
gage heights 41–42
rating table 42
Wagner Creek at:
discharge 46
Tampico, Wash.,
Atanum Creek (North Fork) near:
description 184
discharge 184
discharge, monthly 185, 395
gage heights 184–185
rating table 185
Atanum Creek (South Fork) near:
description 189
discharge 190, 206
discharge, monthly 191, 395
gage heights 190
rating table 190
Nasty Creek at:
discharge 206
Tangent, Oreg.,
Callapooya River near:
discharge 388
Tetherow, Oreg.,
Deschutes River near:
discharge 338
Tetherow Gulch:
discharge 206
Teton River near—
St. Anthony, Idaho:
description 228
discharge 229
discharge, monthly 230, 395
gage heights 229–230
rating table 230
The Dalles, Oreg.,
Columbia River at:
description 67–69
discharge 69, 85
discharge, monthly 72–79, 394
discharge, yearly 79–80
discharge curve, plate showing 68
gage heights 70–71
rating table 71
Three Creeks at—
Gist, Oreg.:
discharge 339
Tieton River near—
Naches, Wash.:
description 175–176, 177, 180–181
discharge 176, 177, 181
discharge, monthly 176, 180, 183, 395
gage heights 176, 178–179, 181–182
rating tables 176, 179, 182
Tieton River (South Fork), glaciers on, view of 168
Tolo, Oreg.,
power plant near, view of 36
Rogue River near:
description 35
discharge 36
Tolo, Oreg.—Continued.
Rogue River near—Continued. Page.
discharge, monthly 38, 394
gage heights 36–37
rating table 37
Toppenish, Wash.,
Satus Creek near:
description 192
discharge 192
Toppenish Creek near—
Toppenish, Wash.:
description 191
discharge 191
gage heights 191
Toutle River at—
Aschans ranch, Wash.:
discharge 81
Spirit Lake, Wash.:
discharge 80
Kid Valley, Wash.:
discharge 81
Toutle River (South Fork) at—
Toutle, Wash.:
discharge 81
Town canal at—
North Yakima, Wash.:
discharge 207
Tualitin River at—
Forest Grove, Oreg.:
discharge 388
Willamette, Oreg.:
discharge 388
Tumalo, Oreg.,
Wimer and Jensen canal:
discharge 338
Wimer canal:
discharge 338
Tumalo Creek near—
Bend, Oreg.:
description 319–320
discharge 321
discharge, monthly 323–324
gage heights 321
rating tables 322–323
Laidlaw, Oreg.:
description 319–320
discharge 320
discharge, monthly 321, 396
gage heights 320
rating table 321
Tumalo, Oreg.:
discharge 338

U.

Umatilla, Oreg.,
ditches at:
discharge 299
Umatilla River at—
Gibbon, Oreg.:
description 291
discharge 292
discharge, monthly 293, 396
gage heights 292
rating tables 293
Umatilla, Oreg.:
description 296
discharge 99, 296
discharge, monthly 298, 396
gage heights 297
rating table 298

Umatilla River at—Continued.
Yoakum, Oreg.: Page.
description 293–294
discharge 294
discharge, monthly 296, 396
gage heights 294–295
rating table 295
Umatilla River basin, description of 290–291
miscellaneous measurements in 299
stream flow in 291–299
Umpqua River basin, description of 47–48
stream flow in 48–58
Umpqua River near—
Elkton, Oreg.:
description 50–51
discharge 51
discharge, monthly 53
gage heights 51–52
rating table 52
Umpqua River (North Fork) near—
Oakcreek, Oreg.:
description 53–54
discharge 54
discharge, monthly 394
gage heights 55
Winchester, Oreg.:
description 53–54
gage heights 55
Umpqua River (South Fork) near—
Brockway, Oreg.:
description 48
discharge 48
discharge, monthly 50, 394
gage heights 49
rating table 50
Umtanum, Wash.,
Yakima River at:
description 143–144
discharge 144
discharge, monthly 145–146, 394
gage heights 144–145
rating table 145
Underwood, Wash.,
White Salmon Creek at:
discharge 80
Union, Oreg.,
Catherine Creek near:
description 275
discharge 275
Union Gap canal at or near—
Prosser, Wash.:
discharge 207
Yakima, Wash.:
discharge 207

V.

Vale, Oreg.,
Bully Creek near:
description 260
discharge 284
discharge, monthly 261, 395
gage heights 281
rating table 261
Malheur River near:
description 257, 258
discharge 258
discharge, monthly 259, 395
gage heights 258
rating tables 259
Valley Creek near—
Ravalli, Mont.: Page.
description 116
discharge 116
Velocity method, description of 19–23
plate showing 20

W.

Wagner Creek at—
Talent, Oreg.:
discharge 46
Walla Walla River basin, description of 285
stream flow in 285–290
Walla Walla River near—
Milton, Oreg.:
description 285–286
discharge 286
discharge, monthly 287, 396
gage heights 286
rating table 287
Walla Walla River (South Fork) near—
Milton, Oreg.:
description 287–288
discharge 288
discharge, monthly 290, 396
gage heights 288–289
rating table 289
Wallowa River at or near—
Elgin, Oreg.:
description 278–279
discharge 279
discharge, monthly 280, 395
gage heights 279
rating table 280
forks, Oreg.:
discharge 284
Wallowa River near—
Joseph, Oreg.:
description 275
discharge 275
discharge, monthly 277, 395
gage heights 276
rating table 277
Lovely, Oreg.:
discharge 284
Wallowa, Oreg.:
description 277
discharge 277
discharge, monthly 278, 395
gage heights 278
rating table 278
Walters, M. I., work of 31
Wapato, Wash.,
Old Reservation canal near—
description 197–198
discharge 198, 200
discharge, monthly 199, 200
gage heights 198–199, 200
rating table 199, 200
Sunnyside canal near—
description 201
discharge 201, 202
discharge, monthly 204
gage heights 202–203
losses from 202
rating table 204
Yakima River near—
description 150
discharge 150

Page.
Wapato, Wash.—Continued.
Yakima River near—Continued.
discharge, monthly 152
gage heights 151
rating table 151
Warm Springs Agency, Oreg.,
Shitike Creek at:
discharge 339
Waterloo, Oreg.,
Santiam River (South Fork) at:
description 372
discharge, monthly 373, 397
gage heights 373
rating table 373
Water power, stream flow and 11
Water supply, stream flow and 11
Weir method, description of 18–19
Welches, Oreg.,
Still Creek at:
discharge 346
Zigzag Creek at:
discharge 346
Wenatchee River at—
Cashmere, Wash.:
description 130–131
discharge 131
gage heights 132
White Salmon River at—
Underwood, Wash.:
discharge 80
Whiteson, Oreg.,
Yamhill River (South Fork) at:
discharge 388
Whitewater Creek near—
Detroit, Oreg.:
description 371
discharge 372
gage heights 372
Wide Hollow Waste at—
Yakima, Wash.:
discharge 206
Willamette, Oreg.,
Tualitin River at:
discharge 388
Willamette River at or near—
Albany, Oreg.:
description 352
discharge 352
discharge, monthly 354–358, 396
gage heights 353
rating table 354
Portland, Oreg.:
discharge 388
Willamette River (Coast Fork) near—
Goshen, Oreg.:
description 358
discharge 358
discharge, monthly 360
gage heights 359
rating tables 360
Willamette River (Middle Fork) at—
Jasper, Oreg.:
description 349
discharge 349
discharge, monthly 351, 396
gage heights 349–350
rating tables 350–351

Page.
Willamette River basin, description of 346–348
miscellaneous measurements 388
stream flow in 348–388
Williams, A. D., work of 31
Willow Creek, Oreg.:
discharge 265
Wimer & Jensen canal at or near—
Tumalo, Oreg.:
discharge 338
Wimer canal near—
Laidlaw, Oreg.:
description 334–335
discharge 335, 338
discharge, monthly 336
gage heights 335
rating tables 336
Winans, Oreg.,
Hood River at:
description 339–340
discharge, monthly 340, 396
gage heights 340
rating table 340
Winchester, Oreg.,
Umpqua River (North Fork) near:
description 53–54
gage heights 55
Wind River at—
Carson, Wash.:
discharge 80
Wingville, Oreg.,
Goodrich Creek at:
discharge 265
Wood, B. D., work of 31
Woodpecker Creek at—
Detroit, Oreg.:
discharge 388
Woods Creek at—
Philomath, Oreg.:
discharge 388
Wright, Wash.,
Klickitat River at:
discharge 80
Swail Canyon Creek at:
discharge 80

Y.

Yakima, Wash.,
Atanum River near:
description 187
discharge 187
discharge, monthly 189, 395
gage heights 188
rating table 188
New Reservation canal near:
description 192–193
discharge 193
discharge, daily 196
discharge, monthly 196–197
gage heights 194–195
Union Gap canal at:
discharge 207
Wide Hollow Waste at:
discharge 206
Yakima Valley, canals in, data on 192–205
Yakima River at or near—
Chandler, Wash.:
discharge 206

Yakima River at or near—Continued.
Clealum, Wash.: Page.
description 140
discharge 141, 394
discharge, monthly 142-143
gage heights 141-142
rating table 142
Easton, Wash.:
discharge 206
Gibbon, Wash.:
discharge 206
Kiona, Wash.:
description 152
discharge 153, 206
discharge, monthly 154-155, 394
gage heights 153-154
rating table 154
Martin, Wash.:
description 137
discharge 137
discharge, monthly 139-140, 394
gage heights 138
rating tables 139
Prosser, Wash.:
discharge 206
Richland, Wash.:
description 155
discharge 155
gage heights 155-156
Umtanum, Wash.:
description 143-144
discharge 144
discharge, monthly 145-146, 394
gage heights 144-145
rating table 145
Wapato, Wash.:
description 150
discharge 150
discharge, monthly 152
gage heights 151
rating tables 151
Yakima, Wash.:
description 146-147
discharge 147
discharge, monthly 149, 394

Yakima River at or near—Continued.
Yakima, Wash.—Continued. Page.
gage heights 147-148
rating tables 148-149
Yakima River basin, description of 133-135
evaporation in 207-208
miscellaneous measurements in 205-207
stream flow in 135-205
Yamhill River at—
La Fayette, Oreg.:
description 379-380
gage heights 380
Yamhill River (North Fork) at—
La Fayette, Oreg.:
discharge 388
Yamhill River (South Fork) at—
Sheridan, Oreg.:
description 376
discharge 377
discharge, monthly 379, 397
gage heights 377-378
rating tables 378
Whiteson, Oreg.:
discharge 388
Yellowstone Creek near—
mouth:
discharge 81
Yoakum, Oreg.,
Umatilla River at:
description 293-294
discharge 294
discharge, monthly 296, 396
gage heights 294-295
rating table 295

Z.

Zigzag Creek at—
Welches, Oreg.:
discharge 346
Zillah, Wash.,
evaporation station at:
description 208
evaporation 208
precipitation 208
Zindel, Wash.,
Grande Ronde River at:
description 273
gage heights 274

O